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2009 EM&V Report for the Home Energy Improvement Program

Appendices
(Final)

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Appendix A: Glossary of Terms

This glossary presents some of the common terms used throughout this report. The evaluation team has endeavored to define terms the first time they appear in the body of the report and to describe them in context where the authors deem that repeated explanation may warranted.

Deemed Savings: assumed unit savings values used in program design and tracking. See Unit Savings.

EM&V: short for Evaluation, Measurement and Verification - the assessment and quantification of the energy and peak demand impacts of an energy efficiency program.

Energy Savings: kWh savings over a given period of time, generally expressed in savings per year.

Field Verification Rate: the ratio of savings from equipment and measures verified on site versus that reported in the program database; calculated as the product of the quantity verification rate and the measure characteristic verification rate.

Gross Realization Rate: the ratio of verified gross savings to reported gross savings.

Gross Savings: reductions in energy consumption and peak demand based on engineering estimates for known quantities and types of measure installations; gross savings do not account for whether the measures were installed as a result of the program.

Measure characteristic verification rate: reflects discrepancies between reported and verified characteristics related to the efficiency of the equipment installed or the way it was installed. It is the ratio of savings generated by equipment with the characteristics actually installed on-site to the savings generated by equipment with the reported characteristics. This does not include size/quantity, but does include efficiency, installation location, and installation type.

Measure unit savings adjustment factor: the ratio of updated unit savings values to the original deemed savings values used in the program tracking database.

Net Savings: savings attributable to the program, after adjustments for free-ridership.

Peak Demand Reductions: the reduction in peak power demand that is coincident with the utility system peak. When the season is not specified, the implicit assumption is that peak demand reductions are summer peak demand reductions.

Quantity Verification Rate: reflects disparities in quantity and size between the program database and actual, on-site conditions verified by the EM&V team. It is the ratio of the quantity of a given measure verified on site to the quantity of a given measure that was reported, with adjustments for any differences in the equipment size.

Reported Gross Savings: the program savings as reported in the HEIP tracking database.

Unit Savings: the energy or peak demand reductions of a given measure *per unit* installed. Units differ by measure; for example, unit savings may be given as kWh per ton cooling capacity, or peak kW per square foot of window installed.

Verification Rate: See Field Verification Rate.

Verified Gross Savings: the gross savings verified by the EM&V team; these are the final third-party-verified gross savings for the program.

Appendix B: Detailed Impact Analysis Methodology

The impact analysis consisted of three parts:

1. First, the results of the on-site field data collection were used to **derive verification rates by measure.**

2. Next, **unit savings values were updated** by using participant billing data analysis and residential appliance saturations to calibrate energy simulation models for each major measure in each region. The team also used secondary research to derive percent savings estimates for HVAC level 1 tune-ups. An updated unit savings database was created from the model results for 2009 participants.

3. Finally, the team used verification rates and updated unit savings values to **calculate measure- and program-level gross savings**. The impact analysis was comprised of the following steps:

Step 6.1: Update Unit Savings Values

Analysis of Participant Billing Data

In order to determine energy consumption targets for energy model calibrations, Navigant analyzed billing data from ~8,700 HEIP program participants. Data from PEC was in the form of rows containing energy consumption for the past billing period and the billing date. Data was cleaned and converted to energy consumption for each calendar month by the following process:

1. Sum all consumption values for a particular month and year for each site to remove erroneous data[1].
2. Find the number of days in each billing period by subtracting the numeric value of the last date from the current date.
3. Determine the average consumption per day in each billing period by dividing total consumption by number of days.
4. Calculate consumption per day at the beginning and end of each billing period by assuming a constant slope between consumption per day of the previous period and that of the following period, and using that slope to adjust the average consumption per day of the current period.

[1] Erroneous data was stored as multiple lines for the same month: one for the erroneous value, one for the negative of the erroneous value (to cancel it out), and one for the correct value.

5. Assign consumption values to each day of the billing period by assuming that consumption per day linearly follows the slope calculated in (4).
6. Determine consumption for each calendar month by summing the consumption per day for the appropriate days of the two billing periods that contain part of that month. [2]

This data was averaged to produce monthly consumption for each site, using all months prior to the date of the measure installation (the "pre" case). Average monthly consumption was then calculated for each region, for each measure group, and for each measure within each region. These average values were plotted and examined, and it was determined that the participant groups split out by measure and region had large enough differences to merit creating individual models for each.

Average consumption was taken for each measure in each region except for those that had less than 30 sites' worth of billing data[3]; those latter were modeled using the average consumption for the entire region. In addition, the percent of participants with each of the four heating types (gas furnace, heat pump, dual-fuel heat pump, and electric resistance) was calculated for each measure group, to be used in the calibration process.

Disaggregate Billing Data into End-Uses

Once average monthly consumption was determined for each model group, those monthly total values were broken down by end-use using the Navigant billing data end-use disaggregation method. This method is Navigant's standard practice, and has been used in performing numerous residential evaluations nationwide. The basic steps are as follows:

1. **Determine average monthly consumption** for each model group by aggregating monthly participant billing data (described above).
2. **Estimate lighting and domestic hot water (DHW) usage** based on the U.S. DOE's Building America Research Benchmark and a study on lighting usage for the California IOUs (KEMA 2005), using average building size and electric hot water heater saturation for each region.

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[2] This method, while more complex than simply determining the portion of each billing period in each month and assigning a proportional amount of the consumption to that month, is a more accurate way of dividing consumption. The alternative method will tend to reduce the (real) split between the highest and lowest consumption months by assuming that consumption in a given billing period is constant; it is important to get an accurate value for the lowest consumption month, since that drives the end-use disaggregation described below.

[3] Measures that did not have enough participants to be modeled explicitly included Eastern Central AC, Southern Central AC and Attic Insulation, and Western Central AC, Duct Sealing, and Windows.

3. **Calculate the remaining consumption,** which is attributable to HVAC and miscellaneous equipment (all uses other than lighting, DHW, and HVAC), by subtracting lighting and DHW consumption from the monthly average.
4. **Calculate miscellaneous equipment consumption** by:
   a. Identifying the base month, defined as the month with the lowest remaining consumption per day (April for the Northern, Southern and Eastern regions and May for the Western region); assume that heating and cooling (HVAC) consumption accounts for a small fraction of the total in the base month (usually ~10-15% in temperate climates with both heating and cooling).
   b. Subtracting the HVAC consumption in the base month from the remaining consumption; assume that this miscellaneous equipment consumption per day is constant throughout the year.
5. **Calculate HVAC consumption** by subtracting lighting, DHW and equipment consumption from the monthly average.
6. **Split HVAC consumption into heating and cooling** by assigning all winter season (Dec-Mar) HVAC consumption to heating and all summer season (Jun-Sep) HVAC consumption to cooling; split swing season HVAC consumption by assuming heating and cooling are proportional to the heating and cooling degree days in each month.4
7. **Adjust the heating and cooling consumption** in each month by multiplying by the ratio of average heating or cooling degree days for that month in the bill period to those of the same month in a typical year.

The first step in disaggregating monthly energy consumption into end-uses is to break out the uses that can be reliably calculated using engineering algorithms and primary research: lighting and domestic hot water (DHW).

Lighting. Annual lighting consumption per household was estimated using an equation from the US DOE's Building America Research Benchmark (BARB), which gives lighting consumption as a function of square footage of floor area:

$$Annual\ Lighting\ Consumption\ (kWh) = 0.8 * Floor\ Area\ (sf) + 805$$

To break the annual consumption into monthly values it is necessary to derive a seasonal load profile, due to the fact that lighting use increases during the winter months when there is less

[4] Heating and cooling degree days taken from www.degreedays.net, a website which aggregates data from the Weather Underground (www.wunderground.com)

daylight. The seasonal lighting variation profile was derived from a recent CFL monitoring study performed for the California investor-owned utilities (KEMA 2005). The basic steps are as follows:

1. **Determine the percent of total hours and weighted average hours per lamp** that are daylight-sensitive; assume family, kitchen/dining and living rooms are daylight sensitive. Input data and calculated result are shown in Table 2-1 and Table 2-2 below:

Table 2-1: Number of Fixtures and Average Daily Usage by Room Type

Room Type	Daylight Sensitivity	Number of Fixtures	Percent	Average Hours of Use
Bedroom	0	669	27%	1.6
Bathroom	0	400	16%	1.5
Family	1	194	8%	2.5
Garage	0	72	3%	2.5
Hallway	0	184	7%	1.6
Kitchen/dining	1	484	19%	3.5
Living	1	342	14%	3.3
Laundry/utility	0	68	3%	1.2
Other	0	94	4%	1.9

Source: KEMA 2005

Table 2-2: Percent of Total Hours and Weighted Average Daily Usage by Daylight Sensitivity

Type	% of Total Hours	Weighted Average Hours of Use
Daylight Sensitive	58%	3.24
Non Daylight Sensitive	42%	1.65

Source: Calculated from KEMA 2005

2. **Calculate an average percent "night adder"** by assuming an average adder of 0.75 hrs/day for daylight-sensitive lamps and 0.25 hrs/day for non-daylight sensitive; divide these values by the average hours per day and weight by the percent of total hours to get an average night adder (20%).
3. **Determine relative daily usage** by assuming that usage varies linearly from a minimum of (1-Night Adder) in June to a maximum of (1+Night Adder) in Dec; add an additional 20% to December to account for an observed spike in energy consumption in this month, assumed to be due to holiday lighting.
4. **Calculate relative monthly usage** by multiplying daily usage times the number of days in the month.

5. **Derive the monthly variation profile** by dividing each month's usage by the average monthly usage for the whole year. Steps 3, 4, and 5 are shown in Table 2-3:

Table 2-3: Daily Usage, Monthly Usage and Lighting Variation Profile

Month	Relative Daily Usage	Days/Month	Relative Monthly Usage	Lighting Variation Profile
Jan	113%	31	35.09	1.13
Feb	107%	28	29.85	0.96
Mar	100%	31	31.00	1.00
Apr	93%	30	28.02	0.91
May	87%	31	26.91	0.87
Jun	80%	30	24.06	0.78
Jul	87%	31	26.91	0.87
Aug	93%	31	28.95	0.94
Sep	100%	30	30.00	0.97
Oct	107%	31	33.05	1.07
Nov	113%	30	33.96	1.10
Dec	140%	31	43.40	1.40

Source: Calculated from KEMA 2005

The average monthly lighting electricity consumption for each model group was then calculated by multiplying the variation profile by the annual lighting consumption estimate.

Domestic Hot Water. The starting point for determining seasonal hot water end usage was the hot water end-use profiles from the 2008 Building America Research Benchmark. Average gallons per day of hot water are given for each month for dishwasher, clothes washer, baths, showers and sinks, along with the average temperature of the water mains. An example of this data (for Raleigh) is shown in Table 2-4 below:

Table 2-4: DHW Profile for Raleigh, NC

Month	Mains Temp (ºF)	Dishwasher DHW (gal/day)	Clothes Washer DHW (gal/day)	Bath DHW (gal/day)	Shower DHW (gal/day)	Sinks DHW (gal/day)	Total DHW (gal/day)
Jan	55.3	5.0	15	5.39	21.52	19.19	65.80
Feb	54.8	5.0	15	5.40	21.57	19.23	65.90
Mar	56.9	5.0	15	5.34	21.35	19.04	65.44
Apr	61.0	5.0	15	5.23	20.89	18.63	64.44
May	66.1	5.0	15	5.06	20.22	18.03	63.01
Jun	70.8	5.0	15	4.87	19.48	17.37	61.42
Jul	73.9	5.0	15	4.73	18.90	16.86	60.19
Aug	74.6	5.0	15	4.70	18.77	16.74	59.90
Sep	72.7	5.0	15	4.79	19.13	17.06	60.69
Oct	68.7	5.0	15	4.96	19.82	17.68	62.16
Nov	63.6	5.0	15	5.14	20.55	18.33	63.73
Dec	58.9	5.0	15	5.29	21.14	18.85	64.98

Source: 2008 DOE Building America Research Benchmark

To get total monthly DHW consumption, consumption each of the end-uses is multiplied by the saturations of that end use among participants in the region.[5]

Next, monthly electricity consumption for homes with electric domestic hot water was calculated using the monthly total gallons of hot water and the seasonally-adjusted mains water temperatures. This consumption was composed of two pieces: the water heating load and the UA load, which is the heat required to compensate for heat loss from the water heater tank. The equations used are as follows[6]:

[5] Dishwashers were assigned 100% saturation because it was assumed that households without a dishwasher use just as much hot water washing dishes by hand as they would with a dishwasher.

[6] The following is assumed for calculation: Hot Water Temp = 125, Heating Efficiency = 1, Tank UA = 5, Ambient Temp = 70

$$Heating\ Load\ \left(\frac{kWh}{day}\right) = Consumption\ \left(\frac{gal}{day}\right) * 8.31\ \left(\frac{Btu}{gal\ ^\circ F}\right) * (Water\ Temp - Mains\ Temp)(^\circ F)/(Heating\ Efficiency * 3412\ \left(\frac{Btu}{kWh}\right))$$

$$UA\ Load\ \left(\frac{kWh}{day}\right) = Tank\ UA\ \left(\frac{Btu}{hr\ ^\circ F}\right) * (Water\ Temp - Ambient\ Temp)(^\circ F) * 24\ \left(\frac{hr}{day}\right) / (Heating\ Efficiency * 3412\ \left(\frac{Btu}{kWh}\right))$$

The DHW variation profile was then calculated by finding average consumption for each month, and dividing by the average for all months. Table 2-5 shows these calculations for Raleigh:

Table 2-5: DHW Electricity Consumption and Variation Profile for Raleigh

Month	Gal/Day	Mains Temp	Heating Load (kWh/day)	UA Load (kWh/day)	Days/ Month	Total kWh/ month	DHW Variation Profile
Jan	69.1	55.3	11.73	1.93	31	423.5	1.19
Feb	69.2	54.8	11.82	1.93	28	385.3	1.08
Mar	68.7	56.9	11.39	1.93	31	413.1	1.16
Apr	67.6	61.0	10.54	1.93	30	374.2	1.05
May	66.1	66.1	9.49	1.93	31	354.2	1.00
Jun	64.5	70.8	8.51	1.93	30	313.5	0.88
Jul	63.2	73.9	7.87	1.93	31	303.9	0.86
Aug	62.9	74.6	7.72	1.93	31	299.4	0.84
Sep	63.7	72.7	8.12	1.93	30	301.6	0.85
Oct	65.2	68.7	8.95	1.93	31	337.4	0.95
Nov	66.9	63.6	9.99	1.93	30	357.9	1.01
Dec	68.2	58.9	10.98	1.93	31	400.4	1.13

Source: Calculated from the 2008 DOE Building America Research Benchmark

Monthly domestic hot water electricity consumption was then multiplied by the electric hot water saturation to derive average household monthly DHW electric consumption by model group.

Miscellaneous Equipment. After subtracting the hot water and lighting end uses from the monthly household electricity consumption, the remaining consumption is composed of HVAC and miscellaneous equipment, which includes appliances and plug loads. To find the portion of the remaining consumption that is from miscellaneous equipment, remaining consumption per day is calculated for each month, and the month with the minimum daily remaining consumption is identified. This month (April for the Northern, Southern and Eastern regions and May for the Western region) is generally in the spring or the fall, and corresponds to the time of lowest HVAC use. Next, it was assumed that during this minimum consumption month, HVAC accounted for 10% of total consumption (past experience has shown this to be a reasonable assumption). Daily equipment consumption for this minimum month was then calculated as the total consumption per day minus the consumption of lighting, DHW and HVAC. This equipment consumption per day is assumed to remain constant throughout the year.

It was assumed that during the minimum consumption month (May), heating and cooling each make up 5% of the total electricity consumed for that month. The base, non-seasonal monthly electricity consumption was then calculated as the total consumption for May minus the seasonal end uses for May. This includes all appliances, plug loads, and other non-seasonal end uses.

Heating and Cooling. Navigant's experience has shown that heating and cooling energy still makes up 10% of total electricity consumption in typical homes in the minimum consumption. After assuming that the minimum consumption month included 5% heating and 5% cooling, the monthly heating and cooling electricity was calculated by subtracting the hot water, lighting, and base end uses from the total for each month. For June to September, all of the heating and cooling electricity is assumed to be cooling. For December to March, all of the heating and cooling electricity is assumed to be heating. For the last month, November, it is assumed that half the heating and cooling electricity is used for cooling and half is used for heating. The annual heating and cooling end uses were then calculated by summing the monthly heating and cooling end uses.

Create Energy Simulation Models

The energy models used in this evaluation were built using the DOE2.2 engine, and were based on the models used in the creation of the North Carolina Measures Database (which were in turn based on the models used in creating the California Database of Energy Efficiency Resources). Each of the models consists of four buildings: two each of single- and two-story homes, oriented N-S and E-W. Four base models were created for each model group, with differing HVAC types:

1. Air-source heat pump with electric resistance supplemental
2. Air-source heat pump with gas supplemental (dual-fuel heat pump)
3. Central AC with gas furnace, and

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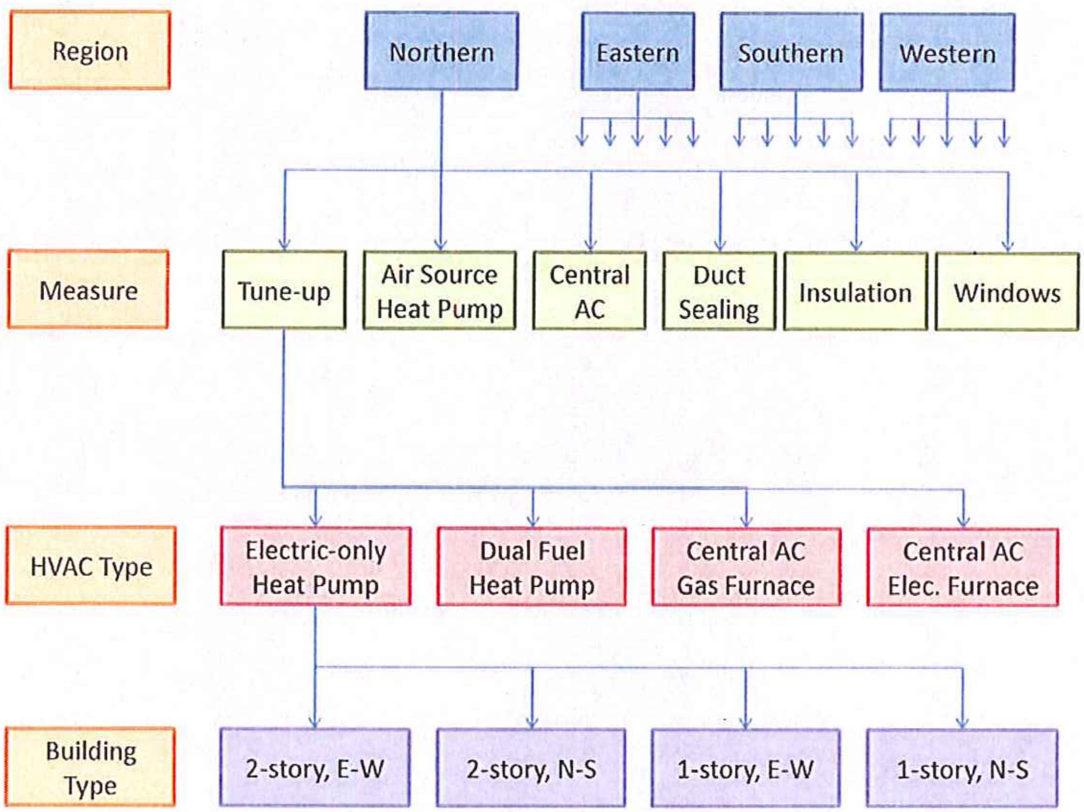
4. Central AC with electric furnace.[7]

These models were altered to match the participants in each model group by changing the average building size and other characteristics where participant data was available. The model hierarchy is depicted in Figure 2-1 below:

Figure 2-1 Building Energy Simulation Models



Source: Navigant

Calibrate Energy Simulation Models

Calibration was performed on each model group in order to match model energy consumption to the end-use targets for that group. Some model groups did not have a large enough group of participants to give a high degree of confidence in the billing data results; these groups were

[7] For HVAC equipment measures, not all of the base models were needed.

calibrated to the average billing data for the region.[8] Within each model group, all building envelope characteristics were kept the same across the models of different heating types. Calibration was an iterative process, involving the following steps:

1. **Derive modeled end use consumption for each model group** by weighting the eight sets of results (single- and two-story for each of the four heating types) from each simulation run by the percent of homes that were two-story (73%, from field data) and the heating type saturation of the participant group.
2. **Compare the modeled end-use consumption to the calculated participant end-use consumption.**
3. **Adjust calibration parameters and re-run the models.**

This process was repeated until the monthly error and total annual error in each end-use was reduced to no more than 1% of the annual end use target. Calibration parameters were adjusted within pre-determined reasonable ranges, in order to avoid getting unrealistic building characteristics.

Derive Unit Savings

Secondary research was conducted to determine reasonable baseline and efficient cases for each measure. For certain measures (windows, attic insulation) the range of possible scenarios was narrowed to a few base- and efficient-case options, based on the groupings of measure specifics in the program tracking data. Next, parametric model runs were performed for each model group by altering the measure parameters in the calibrated models while leaving all other parameters constant. Finally, unit savings were calculated for all combinations of base and efficient cases by taking the difference between energy consumption and peak demand of the corresponding base and efficient model runs.[9] The final results were compiled into a new database of savings values specific to HEIP, broken down by region, heating type, and several base- and efficient-case options for each measure.

Step 6.2: Derive Verification Rates

In order to determine field verification rates, the results of the field data collection activity were compared with the claimed installations to check for both *quantitative* and *qualitative* differences. For each measure-site combination in the field sample, the field data was first checked for

[8] The central AC measure in the East, central AC and attic insulation measures in the South, and central AC, duct sealing and windows measures in the West were all modeled using the average participant data for their respective regions.

[9] The one exception to this method was the HVAC level 1 tune-up measure; for this measure savings were calculated by taking a percent savings of heating and cooling energy consumption and applying it to the baseline consumption of the calibrated energy models.

completeness and accuracy, then compared to the tracking data. The findings were aggregated across each measure in order to determine two adjustment factors:

1. **Quantity Verification Rate:** this was calculated as the total quantity/size found at all sites in the sample divided by the sum of what was reported in the tracking data for the same sites. For example, at a home with attic insulation, the ceiling area insulated was measured at 1100 square feet, while the tracking database gave 1000 square feet. The resulting quantity verification rate for that site was 110%.

2. **Measure Characteristic Verification Rate:** for each site in the sample, the efficiency, installation location, and installation quality of what was installed was compared to the value reported in the program database. Where there was a discrepancy, a new unit savings value was mapped in from the updated savings database (described below). The measure characteristic verification rate was then calculated as the updated savings of the measures found in the field divided by the updated savings of what was reported in the tracking database, using the quantity reported in the tracking data (to avoid double counting).

The final **verification rate** for each measure was calculated as the product of the **quantity verification rate** and the **measure characteristic verification rate**. In this fashion, energy and peak demand verification rates were calculated for each measure except level 1 tune-ups and geothermal heat pumps, which were assigned average verification rates. Level 1 tune-ups were considered too difficult to verify with any degree of accuracy and geothermal heat pumps were too few in number to have a significant impact on the total program savings. Air-source heat pumps and central air conditioners were lumped together for this analysis, because they are installed by the same contractors, with the same general process and opportunities for mistakes.

Step 6.3: Calculate Program Impacts

Map Updated Savings to Program Tracking Database. Once updated unit savings values were derived from the model runs, they were applied to the tracking data to determine program-level results. Each line item in the tracking database was mapped to a new savings value, based on the region, heating type, and best available match of base- and efficient-case measure characteristics. These new unit savings values were then multiplied by the measure quantity to derive total savings for each line item. Finally, total gross savings values were summed by measure over the whole program.

Appendix C: Supplemental Findings

Appendix C provides supplemental findings on the following topics:

1. Statistical significance of impact findings
2. Participation mapping across the PEC service territory

APPENDIX C-1: Statistical Significance of Impact Findings

Sampling precision for the field verification was determined for each sample stratum's verification rate using a 90% confidence interval. The analysis was conducted for the five measures for which onsite verification was performed (AC, heat pump, duct sealing, windows, and attic insulation), and AC and heat pumps were combined into one stratum, as presented in the body of this EM&V report. Precision values were calculated using stratified ratio estimation, in which the stratum verification rate (i.e., the weighted average ratio between verified and reported savings for sample measures of a given type) was multiplied by the adjusted gross savings (i.e, reported gross savings adjusted for the measure unit savings adjustment factors) for each sampled site measure in the stratum to yield a set of predicted savings values for each sampled measure.[10] The difference between each verified savings value and the same site's predicted value was then the basis for determining a variance for the stratum that was used for purposes of statistical precision calculations.

The precision calculation was based on the final field verification rates for each measure, which combine both the "quantity verification rates" and the "measure characteristic verification rates." However, for six of the sixty-four sampled sites, the EM&V team was not able to verify one or the other of these verification rates; therefore, for purposes of the statistical calculations, the analysis included only the fifty-eight sites for which a complete verification rate could be calculated.[11]

The verification rates by measure are presented in Table 3-1 The overall confidence and precision of the energy and peak demand verification rates each 90/5, indicating a 5% relative precision at a 90% level of confidence. Results for individual strata are generally less precise,

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[10] The evaluation team stratified the sample by measure type. Ratio estimation refers to the method of assessing the statistical significance of reported savings. Rather than merely analyzing the verified savings values for each project in the sample, the evaluation analyzed the ratio of verified savings to reported savings (adjusted for changes in measure unit savings values), which generally reduces the variability of data across sampled sites, and thus lowers the coefficient of variation.

[11] Reducing the number of sites used in the analysis can be expected to lower the precision of the findings unless there is a correlation between the quantity and the measure characteristic verification rates for a given site.

with the exception of the heat pump and AC stratum, which was approximately 90/1 (i.e., virtually all sampled installations were verified as properly installed to the same specifications as indicated in the program records). This suggests that some of the individual measure verification rates have relatively high uncertainty and should be interpreted with caution, while the overall program verification rates have relatively low uncertainty and can be viewed as reliable indicators of program performance.

Table 3-1: Uncertainty of Field Verification Rates for Energy Savings and Peak Demand Reductions

	Relative Precision Based on 90% Confidence Interval (+/- %)	
	Energy Savings	Demand Reductions
Total[a]	**90/5**	**90/5**
Heat Pump/AC	90/1	90/0.2
Duct Sealing	90/18	90/18
Windows	90/4	90/9
Attic Insulation	90/25	90/30
Level 1 HVAC Tune-up	N/A	N/A
Geothermal Heat Pump	N/A	N/A

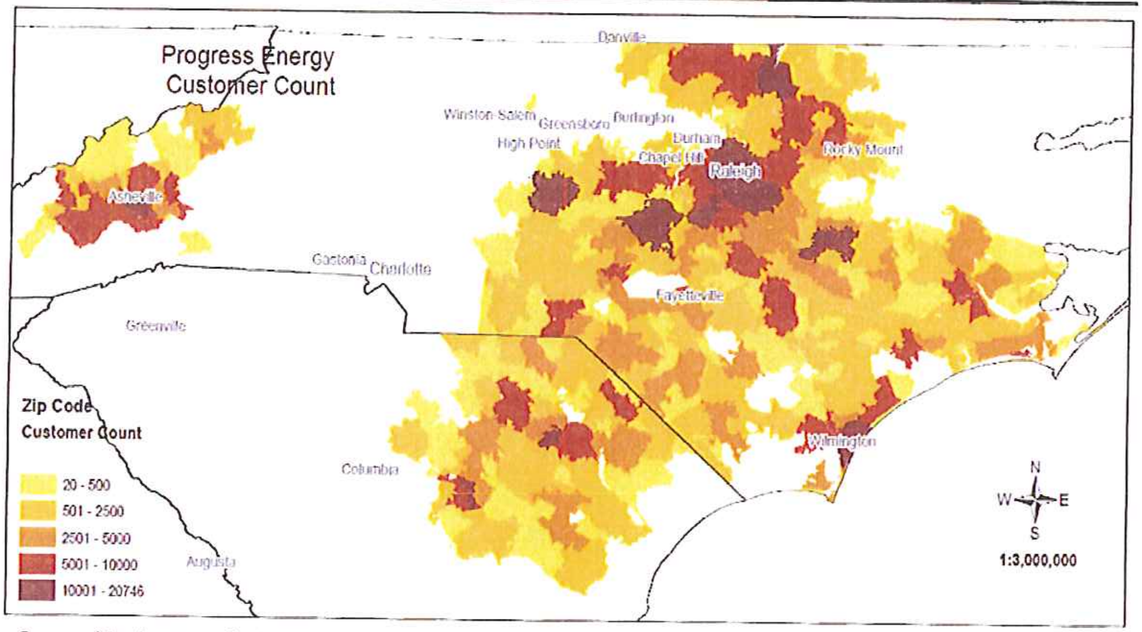
a. The "total" category precision values for energy savings and for demand reductions are a function of both the relative variability within each stratum and the relative energy savings (or peak demand reductions) across the individual strata. Since the relative savings are different for energy and demand, the relative precision levels for energy and demand do not necessarily have to be equal.

Source: Navigant analysis

APPENDIX C-2: Participation Mapping Across the PEC Service Territory

Navigant used Geographic Information Systems (GIS) to analyze the distribution of HEIP program participants and pull out trends that can inform future program design decisions. GIS is used to combine datasets at a geographical level to provide insights into spatial distributions and the reasons for those distributions. In the context of a utility energy efficiency program, GIS analysis can show program staff where participation rates are relatively high or low and where to concentrate future efforts. The first map, Figure 3-1 shows total PEC customers by zip code.

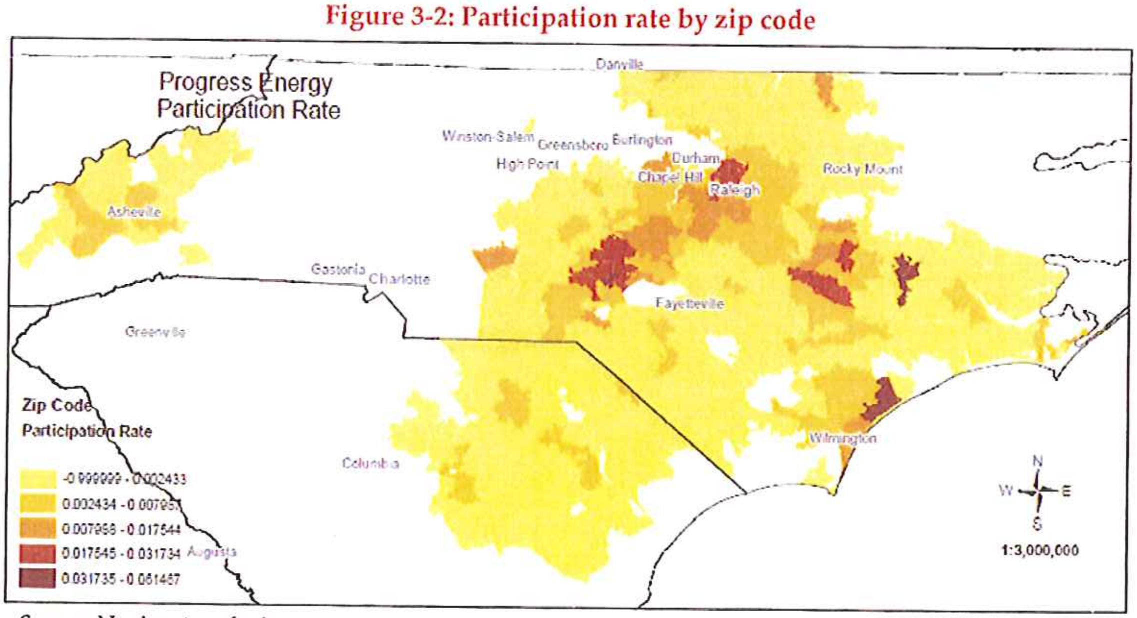
Figure 3-1: Total PEC Customers by Zip Code



Source: Navigant analysis

This map is primarily useful for drawing comparisons to maps of participation. Figure 3-2 shows the overall participation rate (participants per customer) by zip code.

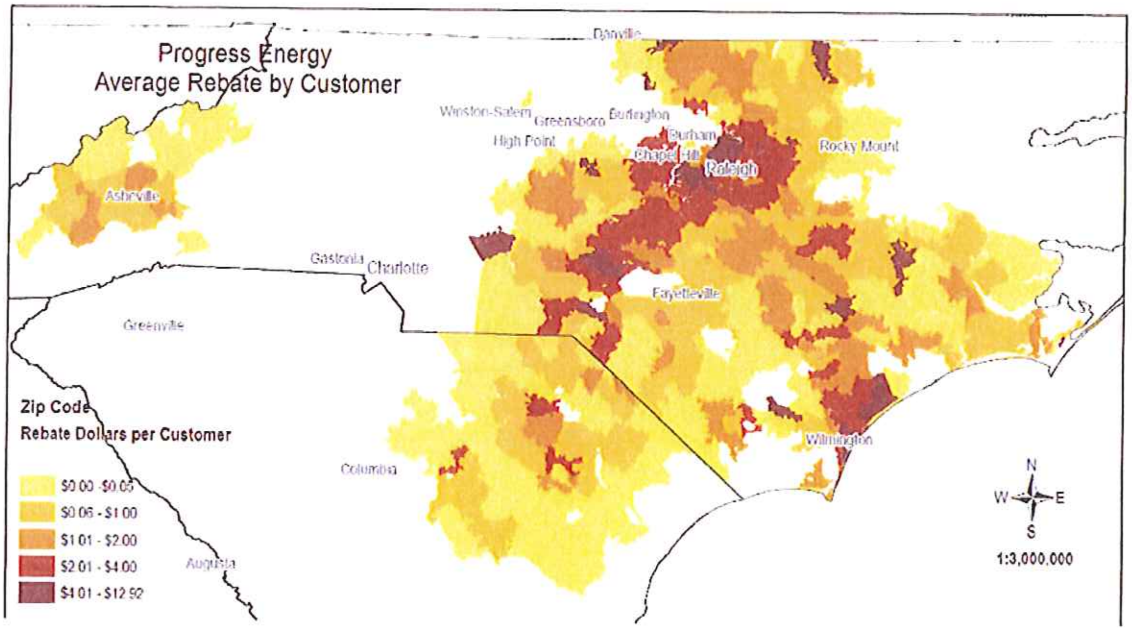
Figure 3-2: Participation rate by zip code



Source: Navigant analysis

The average participation rate is approximately 0.8%, so the two lightest colored regions have below average participation, and the lightest colored regions have extremely low participation. There are some populous areas that have low participation, according to this map. Cities in North Carolina in PEC territory with below average participation include Asheville, Fayetteville, Asheboro, Henderson, and Rockingham. Conversely, the Raleigh, Wilmington, and Southern Pines areas all have strong participation. As participation levels rise, it may be beneficial to target the lagging areas with additional marketing and contractor outreach so that incentive dollars flow evenly across the entire service area. Figure 3-3 shows the current incentive dollar spending per customer by zip code.

Figure 3-3: Rebate dollars per customer

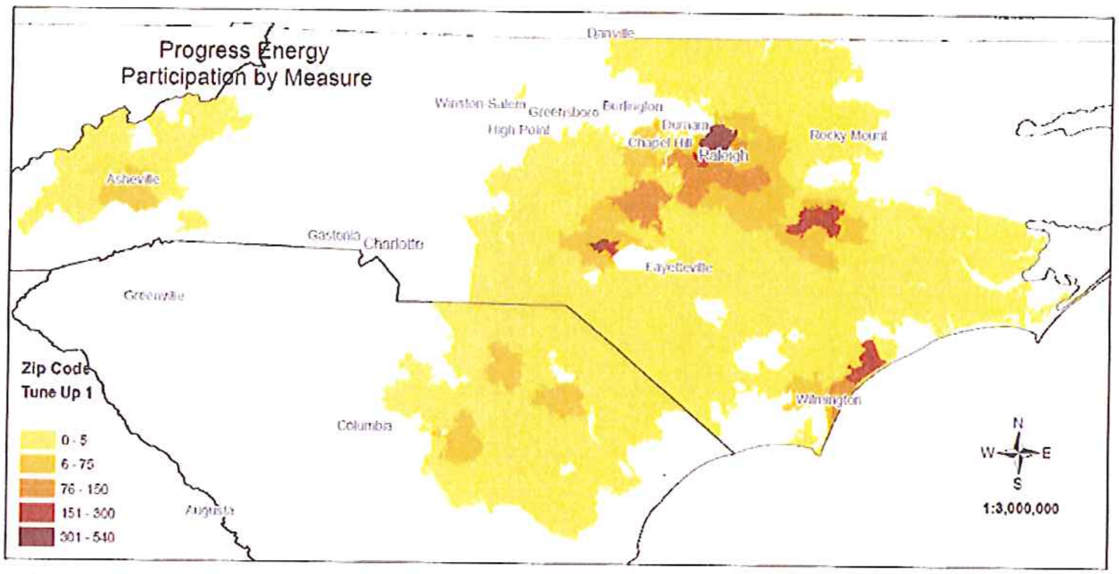


Source: Navigant analysis

The participation rate largely drives the distribution of rebate dollars.

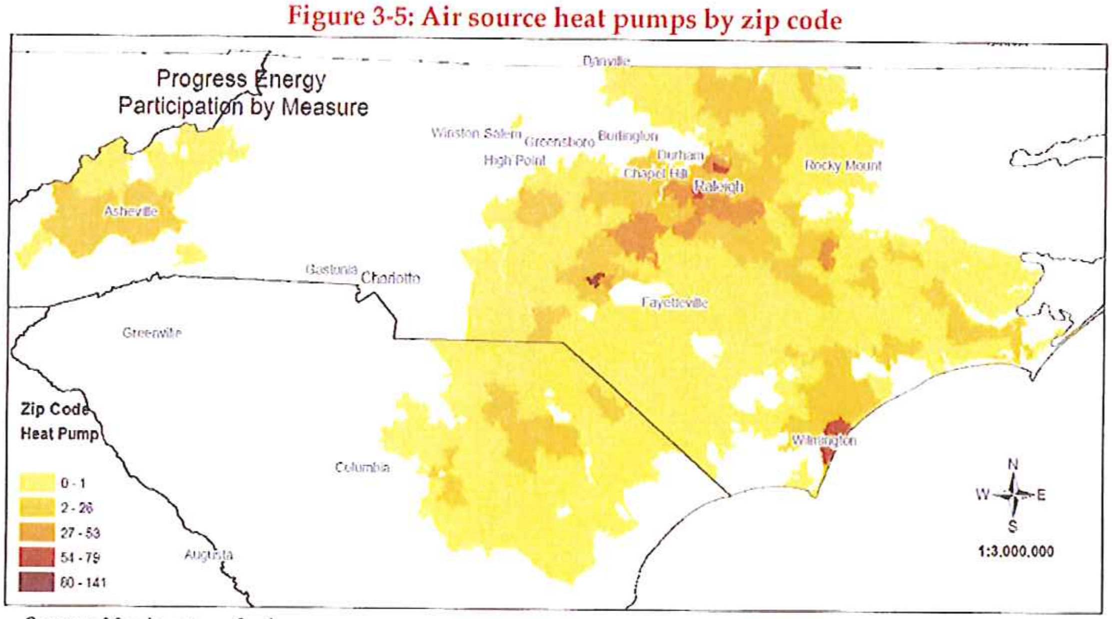
Level 1 tune-up and air-source heat pump installations, shown in Figure 3-4 and Figure 3-5, are concentrated in Raleigh, Wilmington, and Southern Pines, with a small amount of activity in other areas. This likely reflects where the largest contractors doing this work are located.

Figure 3-4: Level 1 Tune-ups by zip code



Source: Navigant analysis

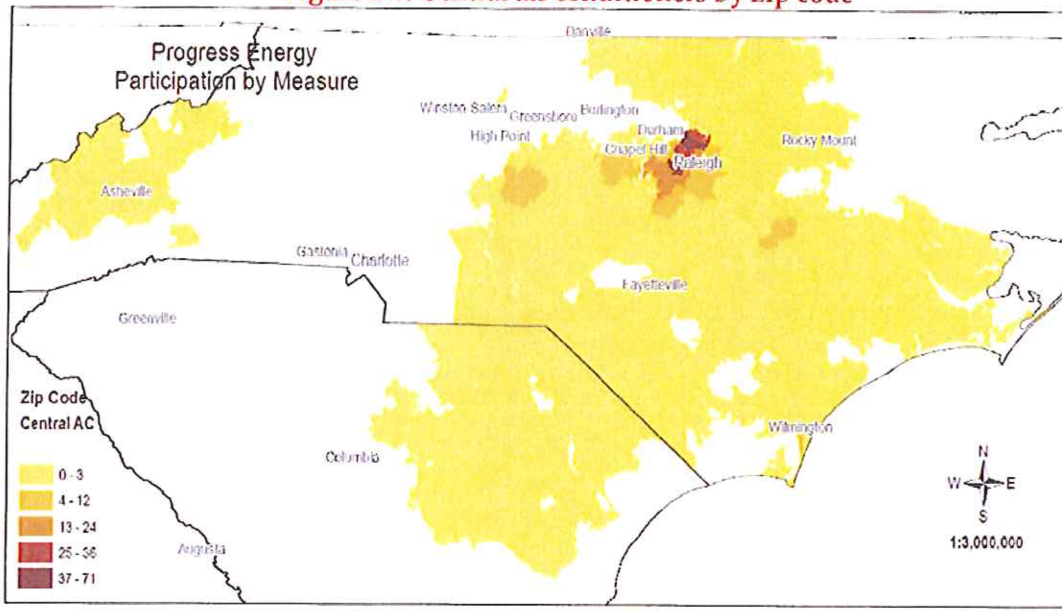
Figure 3-5: Air source heat pumps by zip code



Source: Navigant analysis

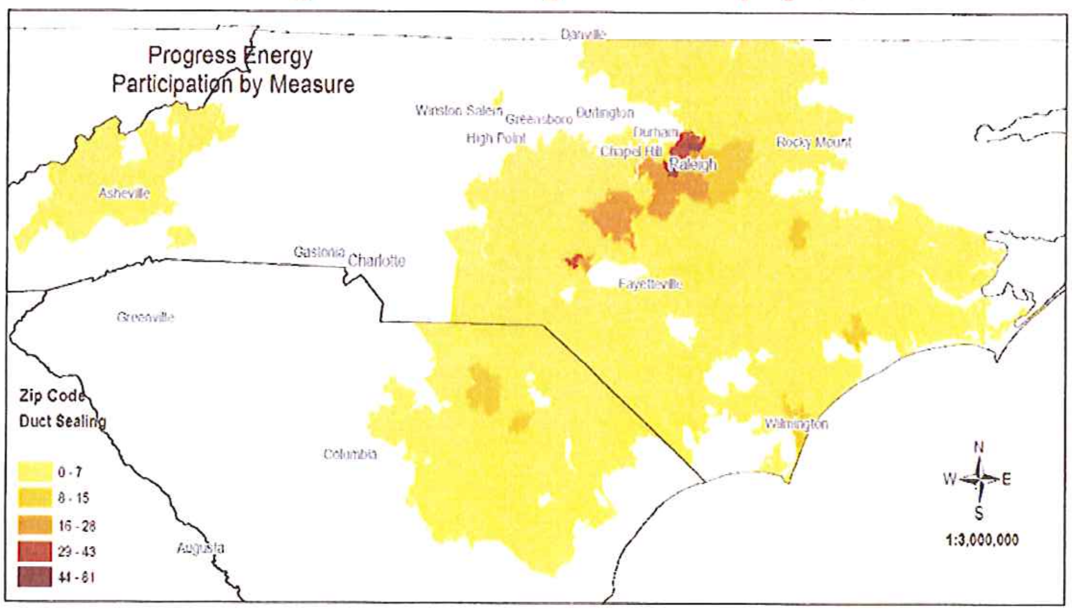
Central air conditioner installations were mostly limited to the Raleigh area, as shown in Figure 3-6. Duct sealing, shown in Figure 3-7, is concentrated in Raleigh and Southern Pines. Duct sealing was generally performed in conjunction with new equipment installations. The hot spots for duct sealing installations generally align with those of air-source heat pumps, with the exception of Wilmington, where duct sealing rates are notably lower.

Figure 3-6: Central air conditioners by zip code



Source: Navigant analysis

Figure 3-7: Duct sealing installations by zip code



Source: Navigant analysis

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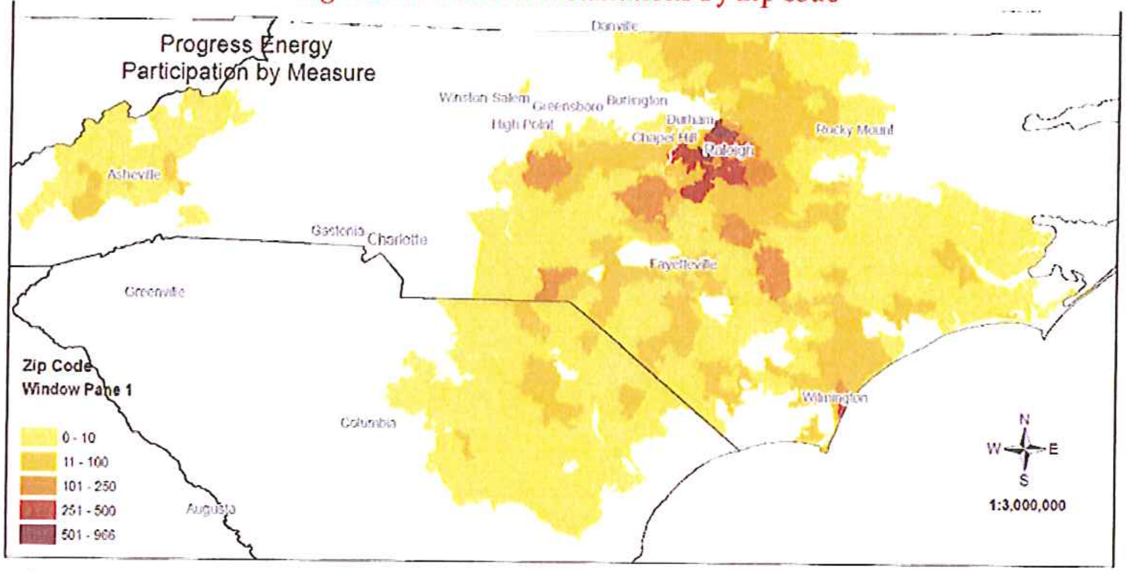
Figure 3-8 shows that window installations were more spread across the service territory, with some concentration in Raleigh. This is somewhat different than the HVAC measures, which had a notable hot spot in Southern Pines.

Figure 3-8: Window installations by zip code



Source: Navigant analysis

Overall, the GIS analysis shows that there are plenty of opportunities for program growth across PEC's service area.

Appendix D: Updated Unit Savings Values

Updated unit savings applicable to typical measure installations were presented in Chapter 4 of the report. These average unit savings values were based on 2009 participants' mix of measure efficiency, heating type, and region. Below are unit savings values broken out by these three characteristics. These unit savings do not include adjustments due to field verification rates from the EM&V sample; rather, they reflect anticipated savings if a measure were installed as recorded in the program database. Each of the values in the table reflect the weighted average across that particular group of 2009 participants.

Table 4-1 shows the measure unit savings by efficiency level.

Table 4-1: Measure Unit Savings by Efficiency Level

Measure	Base_Case	Efficient_Case	Units	kWh	Summer kW	Winter kW
Air-Source Heat Pump	SEER 13	SEER 15	Tons	108	0.144	0.003
Air-Source Heat Pump	SEER 13	SEER 16	Tons	162	0.172	0.026
Air-Source Heat Pump	SEER 13	SEER 17	Tons	186	0.158	0.038
Air-Source Heat Pump	SEER 13	SEER 18	Tons	228	0.201	0.035
Attic Insulation	R-03	R-30	SF Ceiling	1.34	0.00059	0.00129
Attic Insulation	R-03	R-38	SF Ceiling	1.39	0.00061	0.00134
Attic Insulation	R-03	R-49	SF Ceiling	1.42	0.00062	0.00138
Attic Insulation	R-08	R-30	SF Ceiling	0.83	0.00035	0.00082
Attic Insulation	R-08	R-38	SF Ceiling	0.87	0.00037	0.00086
Attic Insulation	R-08	R-49	SF Ceiling	0.91	0.00038	0.00090
Attic Insulation	R-12	R-30	SF Ceiling	0.64	0.00026	0.00064
Attic Insulation	R-12	R-38	SF Ceiling	0.68	0.00028	0.00069
Attic Insulation	R-12	R-49	SF Ceiling	0.72	0.00029	0.00073
Attic Insulation	R-19	R-30	SF Ceiling	0.47	0.00018	0.00048
Attic Insulation	R-19	R-38	SF Ceiling	0.52	0.00020	0.00053
Attic Insulation	R-19	R-49	SF Ceiling	0.55	0.00022	0.00057
Central AC	SEER 13	SEER 15	Tons	86	0.097	0.019
Central AC	SEER 13	SEER 16	Tons	98	0.171	0.010
Central AC	SEER 13	SEER 17	Tons	181	0.209	0.020
Central AC	SEER 13	SEER 18	Tons	186	0.230	0.020
Duct Sealing	Ducts in Attic	Ducts in Attic, Visually Inspected	Site	638	0.491	1.126
Duct Sealing	Ducts in Attic and Crawlspace/Basement	Ducts in Attic and Crawlspace/Basement, Visually Inspected	Site	430	0.305	0.725
Duct Sealing	Average Duct Location	Average Duct Location, Visually	Site	363	0.246	0.596

Measure	Base_Case	Efficient_Case	Units	kWh	Summer kW	Winter kW
		Inspected				
Duct Sealing	Ducts Half in Attic and Half in Conditioned Space	Ducts Half in Attic and Half in Conditioned Space, Visually Inspected	Site	319	0.246	0.563
Duct Sealing	Ducts in Crawlspace/Basement	Ducts in Crawlspace/Basement, Visually Inspected	Site	222	0.120	0.323
Duct Sealing	Ducts Half in Crawlspace/Basement and Half in Conditioned Space	Ducts Half in Crawlspace/Basement and Half in Conditioned Space, Visually Inspected	Site	111	0.060	0.162
Duct Sealing	Ducts in Conditioned Space	Ducts in Conditioned Space, Visually Inspected	Site	0	0.000	0.000
HVAC Level 1 Tune-up	No Tune-up	Level 1 Tune-up	Site	146	0.137	0.064
Windows	Double Pane	U-0.24, SHGC 0.23	SF Windows	1.84	0.00218	0.00023
Windows	Double Pane	U-0.25, SHGC 0.29	SF Windows	1.86	0.00199	0.00033
Windows	Double Pane	U-0.25, SHGC 0.40	SF Windows	2.03	0.00170	0.00070
Windows	Double Pane	U-0.30, SHGC 0.23	SF Windows	1.33	0.00202	0.00015
Windows	Double Pane	U-0.30, SHGC 0.30	SF Windows	1.46	0.00177	0.00018
Windows	Double Pane	U-0.30, SHGC 0.41	SF Windows	1.67	0.00156	0.00036
Windows	Double Pane	U-0.33, SHGC 0.24	SF Windows	1.11	0.00192	0.00011
Windows	Double Pane	U-0.35, SHGC 0.29	SF Windows	1.07	0.00175	0.00011
Windows	Double Pane	U-0.35, SHGC 0.38	SF Windows	1.20	0.00150	0.00015
Windows	Single Pane	U-0.24, SHGC 0.23	SF Windows	4.03	0.00321	0.00166
Windows	Single Pane	U-0.25, SHGC 0.29	SF Windows	4.04	0.00302	0.00196
Windows	Single Pane	U-0.25, SHGC 0.40	SF Windows	4.21	0.00273	0.00234
Windows	Single Pane	U-0.30, SHGC 0.23	SF Windows	3.51	0.00305	0.00131
Windows	Single Pane	U-0.30, SHGC 0.30	SF Windows	3.65	0.00279	0.00157
Windows	Single Pane	U-0.30, SHGC 0.41	SF Windows	3.85	0.00258	0.00199
Windows	Single Pane	U-0.33, SHGC 0.24	SF Windows	3.29	0.00295	0.00117
Windows	Single Pane	U-0.35, SHGC 0.29	SF Windows	3.26	0.00278	0.00127
Windows	Single Pane	U-0.35, SHGC 0.38	SF Windows	3.38	0.00253	0.00164

Table 4-2 shows unit savings by heating type.

Table 4-2: Measure Unit Savings by Heating Type

Measure	Heat_Type	Units	kWh	Summer _kW	Winter _kW
Air-Source Heat Pump	Average	Tons	136	0.156	0.012
Air-Source Heat Pump	Dual Fuel Heat Pump	Tons	156	0.156	0.065
Air-Source Heat Pump	Heat Pump	Tons	134	0.156	0.008
Attic Insulation	Average	SF Ceiling	0.56	0.00025	0.00058
Attic Insulation	Dual Fuel Heat Pump	SF Ceiling	0.56	0.00026	0.00015
Attic Insulation	Electric Resistance	SF Ceiling	1.25	0.00024	0.00120
Attic Insulation	Gas Furnace	SF Ceiling	0.18	0.00024	0.00002
Attic Insulation	Heat Pump	SF Ceiling	0.73	0.00026	0.00096
Central AC	Average	Tons	109	0.159	0.014
Central AC	Electric Resistance	Tons	100	0.160	0.000
Central AC	Gas Furnace	Tons	110	0.160	0.015
Duct Sealing	Average	Site	359	0.247	0.582
Duct Sealing	Dual Fuel Heat Pump	Site	339	0.253	0.103
Duct Sealing	Electric Resistance	Site	628	0.236	0.864
Duct Sealing	Gas Furnace	Site	161	0.236	0.017
Duct Sealing	Heat Pump	Site	468	0.253	0.974
HVAC Level 1 Tune-up	Average	Site	143	0.137	0.058
HVAC Level 1 Tune-up	Dual Fuel Heat Pump	Site	181	0.137	0.132
HVAC Level 1 Tune-up	Electric Resistance	Site	99	0.136	0.000
HVAC Level 1 Tune-up	Gas Furnace	Site	99	0.136	0.000
HVAC Level 1 Tune-up	Heat Pump	Site	181	0.137	0.113
Windows	Average	SF Windows	2.75	0.00256	0.00104
Windows	Dual Fuel Heat Pump	SF Windows	2.60	0.00258	0.00086
Windows	Electric Resistance	SF Windows	2.59	0.00255	0.00208
Windows	Gas Furnace	SF Windows	2.68	0.00255	0.00004
Windows	Heat Pump	SF Windows	2.94	0.00258	0.00141

Table 4-3 shows measure unit savings by region.

Table 4-3: Measure Unit Savings by Region

Measure	Region	Units	kWh	Summer _kW	Winter _kW
Air-Source Heat Pump	Eastern	Tons	178	0.162	0.035
Air-Source Heat Pump	Northern	Tons	120	0.155	0.004
Air-Source Heat Pump	Southern	Tons	132	0.161	0.007
Air-Source Heat Pump	Western	Tons	63	0.116	0.004
Attic Insulation	Eastern	SF Ceiling	0.500	0.00026	0.00050
Attic Insulation	Northern	SF Ceiling	0.681	0.00025	0.00069
Attic Insulation	Southern	SF Ceiling	0.664	0.00029	0.00077
Attic Insulation	Western	SF Ceiling	0.658	0.00022	0.00064
Central AC	Eastern	Tons	94	0.144	0.014
Central AC	Northern	Tons	112	0.162	0.014
Central AC	Southern	Tons	81	0.152	0.016
Central AC	Western	Tons	27	0.062	0.020
Duct Sealing	Eastern	Site	348	0.250	0.492
Duct Sealing	Northern	Site	367	0.238	0.611
Duct Sealing	Southern	Site	369	0.285	0.612
Duct Sealing	Western	Site	345	0.208	0.683
HVAC Level 1 Tune-up	Eastern	Site	153	0.136	0.091
HVAC Level 1 Tune-up	Northern	Site	143	0.135	0.061
HVAC Level 1 Tune-up	Southern	Site	152	0.146	0.043
HVAC Level 1 Tune-up	Western	Site	99	0.107	0.067
Windows	Eastern	SF Windows	3.40	0.00283	0.00148
Windows	Northern	SF Windows	2.60	0.00248	0.00076
Windows	Southern	SF Windows	2.46	0.00254	0.00098
Windows	Western	SF Windows	2.06	0.00276	0.00359

Appendix E: Survey Results

The evaluation team conducted two surveys as part of the 2009 HEIP evaluation. The team surveyed 58 prequalified contractors from the list of those certified at the end of 2009, and also surveyed 138 program participants. For both surveys, the sampling approach was designed to ensure representation for all program measures, e.g. HVAC, duct sealing, and efficient windows. This Appendix provides detailed results from both surveys.

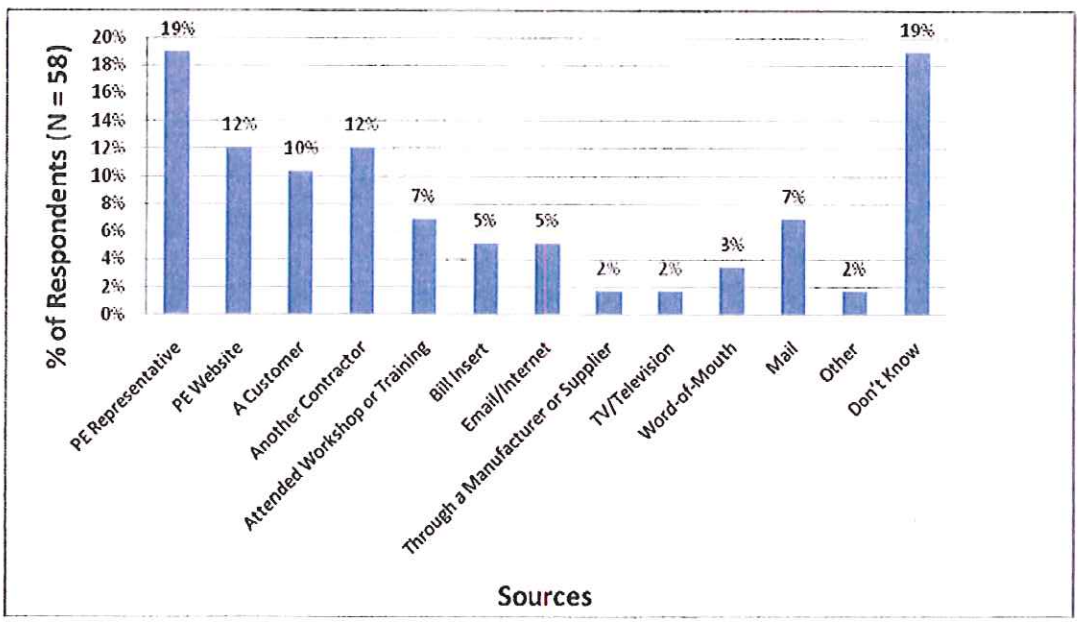
Prequalified Contractor Survey Results

The Contractor surveys were designed to assess multiple program aspects, including program marketing and outreach, program experience, awareness of state and federal tax incentives for high efficiency measures, participant knowledge and interest in energy efficiency, success of program-related training, and overall satisfaction with the program in general.

Program Awareness

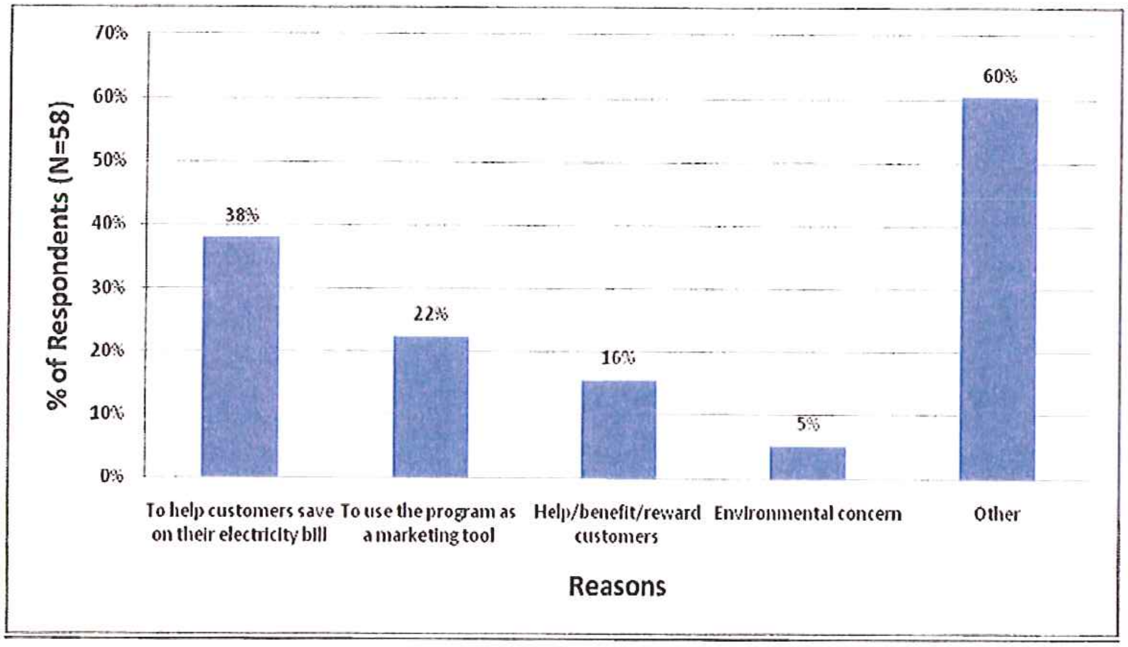
Prequalified contractors learned about the program in a variety of ways: 19% learned about it from a Progress Energy representative and 12% from the Progress Energy website. Another 12% heard about the program from another contractor, while 10% of respondents named a customer as their source. Figure 5-1 shows the full range of responses.

Figure 5-1: Where Contractors Heard About Progress Energy's HEIP Program



Thirty-eight percent of participants surveyed became Progress Energy pre-qualified contractors because they wanted to help customers save on their electricity bill. Twenty-two percent said they were motivated by the ability to use the program as a marketing tool. Only 5% joined out of environmental concerns. Figure 5-2 shows what motivated prequalified contractors to become involved with the program.

Figure 5-2: Why Contractors Decided to Become Progress Energy Prequalified Contractors



Marketing and Outreach

Survey results indicate that almost all prequalified contractors (97%) actively market the HEIP program to customers. Thirty-five percent of contractors commonly use handouts, pamphlets, brochures, and flyers to market the program. Thirty-two percent said that they make comments to customers about rebates and incentives for the various measures that are offered. Twenty-one percent mentioned word-of-mouth marketing as one method used, while 13% said that PEC mentions the program. Full results are shown in Figure 5-3.

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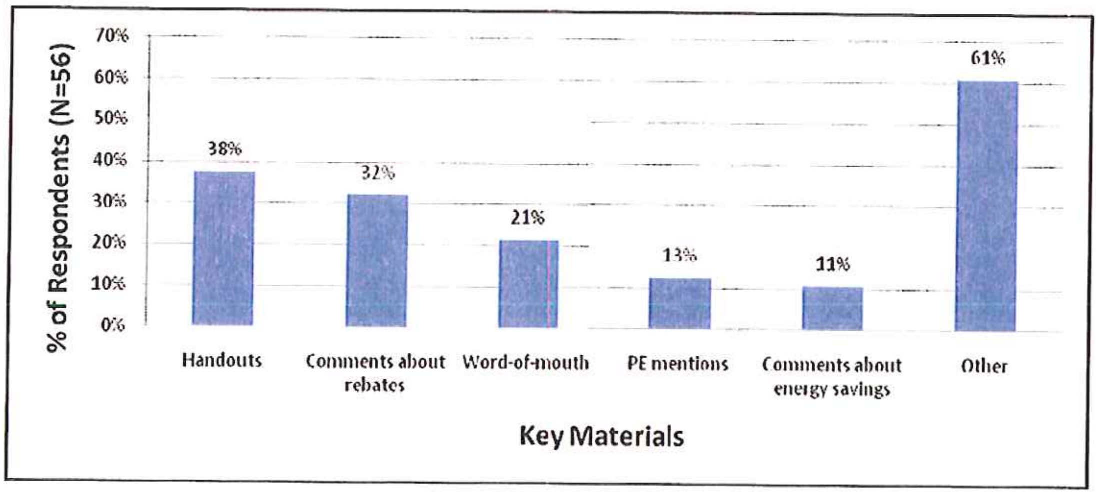
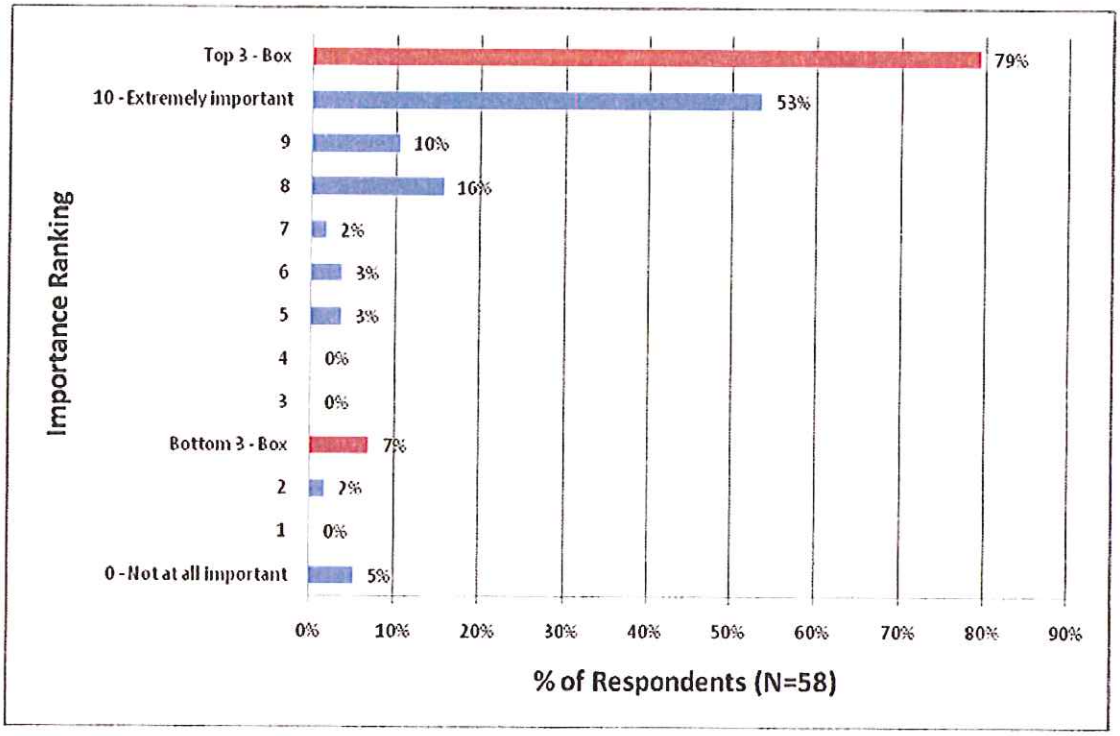
Contractors were asked whether PEC has provided them with the marketing materials they need; nearly three-quarters of the respondents believe they have the tools they need to market the program. The 3% of allies who do not actively market the HEIP program all mentioned that they do not do much marketing or advertising in general.

Figure 5-3: Key Materials and Messages Used to Market HEIP to Customers



NCI asked contractors how important to program success, on a scale of 0 to 10, they consider PEC's program sponsorship to be. Seventy-nine percent of the contractors surveyed believe PEC's sponsorship to be very important or higher. Figure 5-4 shows the full results.

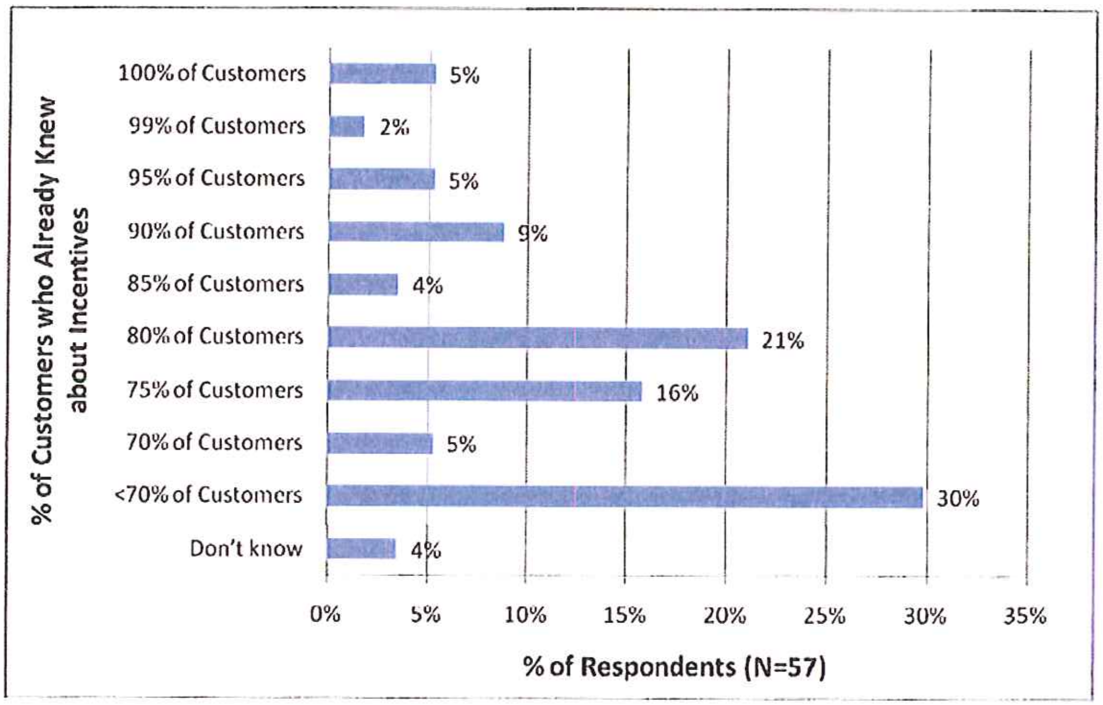
Figure 5-4: Importance of Progress Energy's Sponsorship of the HEIP Program



Awareness of State and Federal Tax Incentives

As part of the American Reinvestment and Recovery Act (ARRA), the Federal government offered tax credits, through the end of 2010, to homeowners who purchased energy efficient HVAC equipment. NCI has found that these programs have had a significant impact on utility rebate programs, and that contractors often combine the utility rebates, Federal tax credit, and sometimes manufacturer incentives into one attractive package for consumers. Our Contractor survey asked participating contractors about their knowledge and experiences with the Federal tax credit, as well as with state rebates. Consistent with national trends, an overwhelming majority of the contractors (98%) said that they were aware of the incentives, and the same percentage said that they always mention these incentives to customers in conversation. Only one Contractor reported only occasionally mentioning the incentives to customers. Contractors were then asked to gauge the percentage of their customers who already knew about the state and federal tax incentives before the contractors told them. Twenty-one percent replied that 90% or more of their customers already knew about the incentives, and 62% replied that 75% or more of their customers already knew about the incentives. Figure 5-5 shows this breakout clearly.

Figure 5-5: Percentage of Customers who Already Knew about Tax Incentives

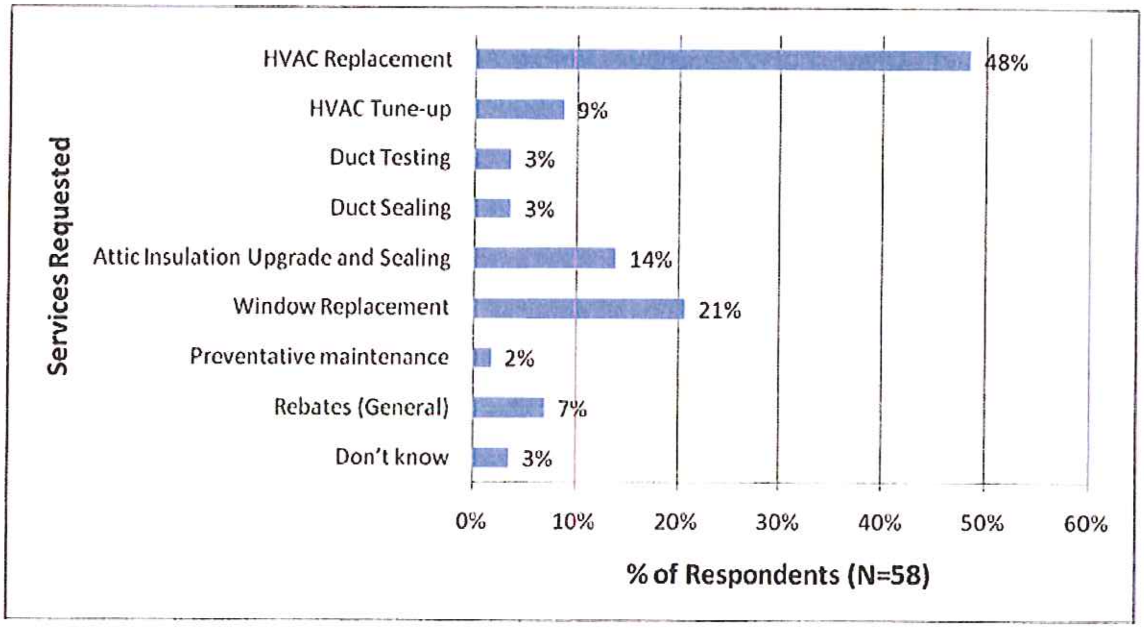


Customer Knowledge and Interest in Energy Efficiency

During 2009, HVAC Replacement and Window Replacement were the services most commonly requested by customers. Forty-eight percent requested HVAC Replacement services and 21% requested Window Replacement. (Figure 5-6)

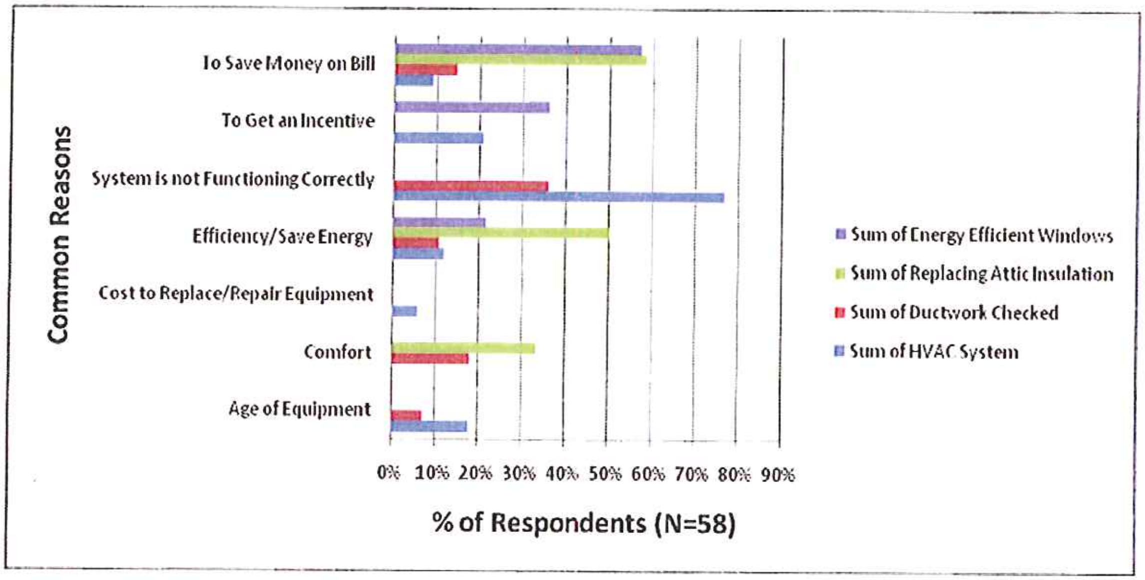
Participating contractors were asked if they had routinely marketed the same program-qualifying services to customers before they began to participate in the HEIP program. Ninety-one percent of the respondents responded that they did in fact market these services before joining the HEIP program, but 7% of respondents claimed that they did not routinely market these services until they began to participate in the HEIP program. Since joining the HEIP program, 50% of respondents say their inventory of high efficiency equipment has increased, and 36% say it has not changed.

Figure 5-6: HEIP Qualifying Services Most Often Requested by Customers



Contractors also were asked what reasons customers most commonly give for choosing various program measures. Customers offer different reasons for each of the four program measures: HVAC system replacement, duct work checking, attic insulation replacement, and energy efficient window installation. Allies said that 76% and 36% of customers had their HVAC system replaced and their duct work checked, respectively, due to the system not functioning correctly. The main motivation for customers to replace their attic insulation and install energy efficient windows is to save money on their energy bills. What all four of these reasons have in common is that customers are looking to save energy and they are looking to save money. (Figure 5-7)

Figure 5-7: Reasons Customers Most Commonly Give for Having Measures Repaired or Upgraded



Success of Program-Related Training

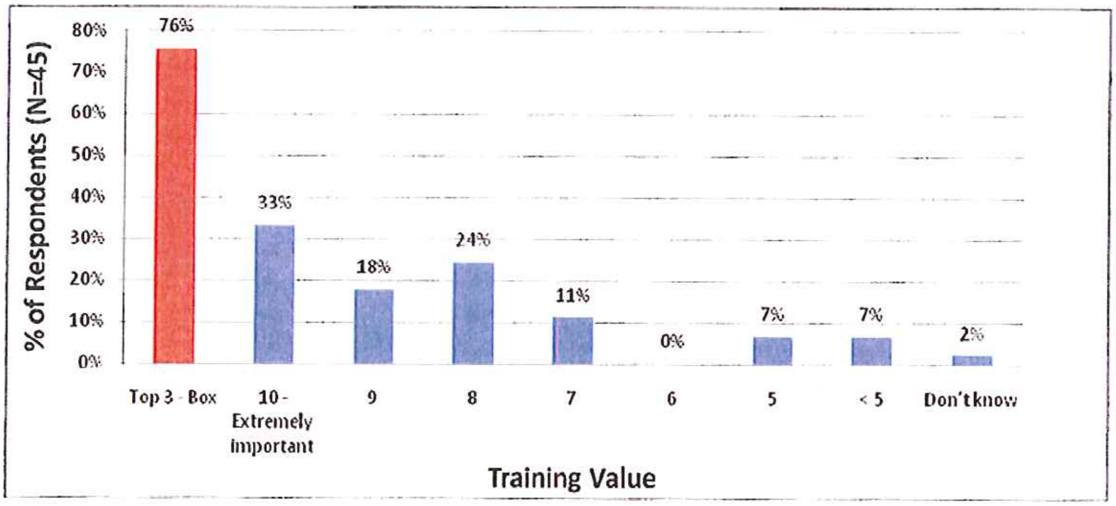
Forty-five of the 58 contractors (78%) participated in the PEC-sponsored program trainings. Of those 45, 76% felt that the training was very valuable, and ranked it above an 8 on a scale of 0 to 10. In fact, only 7% of respondents (4) ranked the program trainings below a 5 on a 10 point rating scale. The respondents who provided low rankings offered the following reasons for doing so:

-*"I use a different process for sealing the attic than conventional method."*

-*"Already know about efficiency of our windows."*

Figure 5-8 shows the full range of responses.

Figure 5-8: How Valuable was Training?



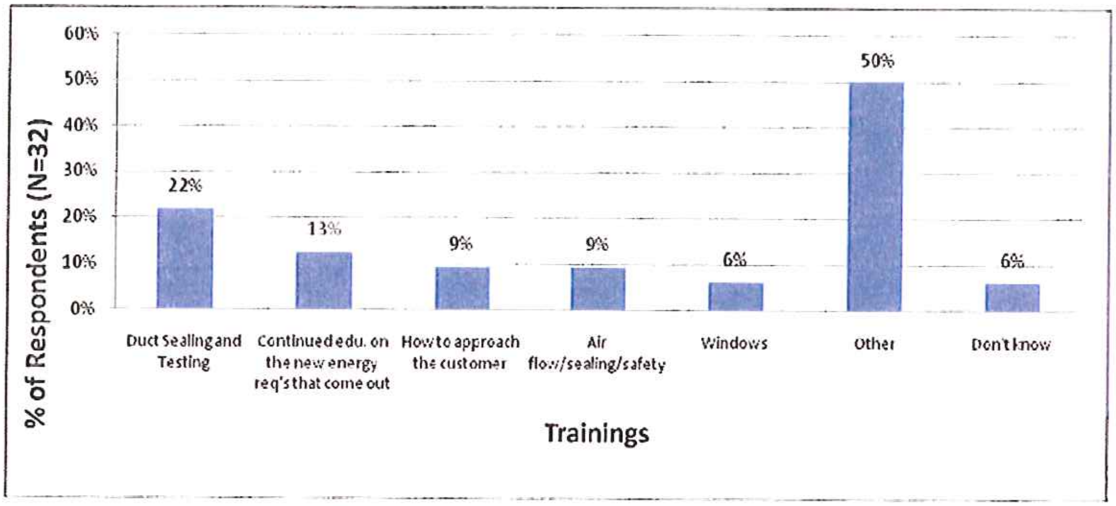
Contractors were then asked if they thought more training would be useful. Fifty-five percent (32 of 58) responded positively, saying they would find more training useful. Those who responded positively were then asked to provide what additional program or technical training would benefit their businesses or employees the most. Of the many options, twenty-two percent mentioned training on duct sealing and testing, 13% listed continued education on new energy requirements that come out, and 9% mentioned training on how to approach customers. An additional 9% mentioned training on air flow, sealing, and safety courses.

Fifty percent of respondents cited other examples of training they would find useful, including:

- Diagnostics training (6%)
- Marketing training (6%)
- Attic insulation (3%)
- Online and phone training (3%)
- More audit training (3%)

Figure 5-9 shows these results.

Figure 5-9: Additional Training that would be useful



Contractor Firmographics

Most of the contractors surveyed are small companies, with 20 or fewer employees (74%).

The following figures show the areas in which the surveyed contractors focus their work. Figure 5-10 shows how many contractors generate business through HVAC tune-ups; Figure 5-11, Figure 5-12, Figure 5-13, Figure 5-14 and Figure 5-15 show the same information for duct sealing, duct testing, HVAC replacement, window replacement, and insulation upgrade and sealing, respectively.

Figure 5-10: Proportion of Overall Business Revenue Generated Through HVAC Tune-up

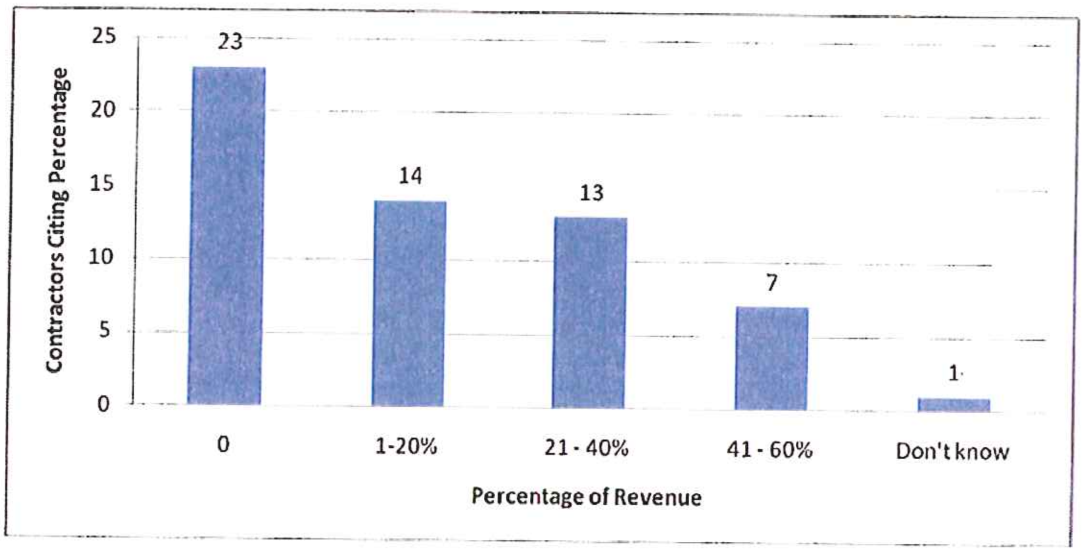


Figure 5-11: Proportion of Overall Business Revenue Generated Through Duct Testing

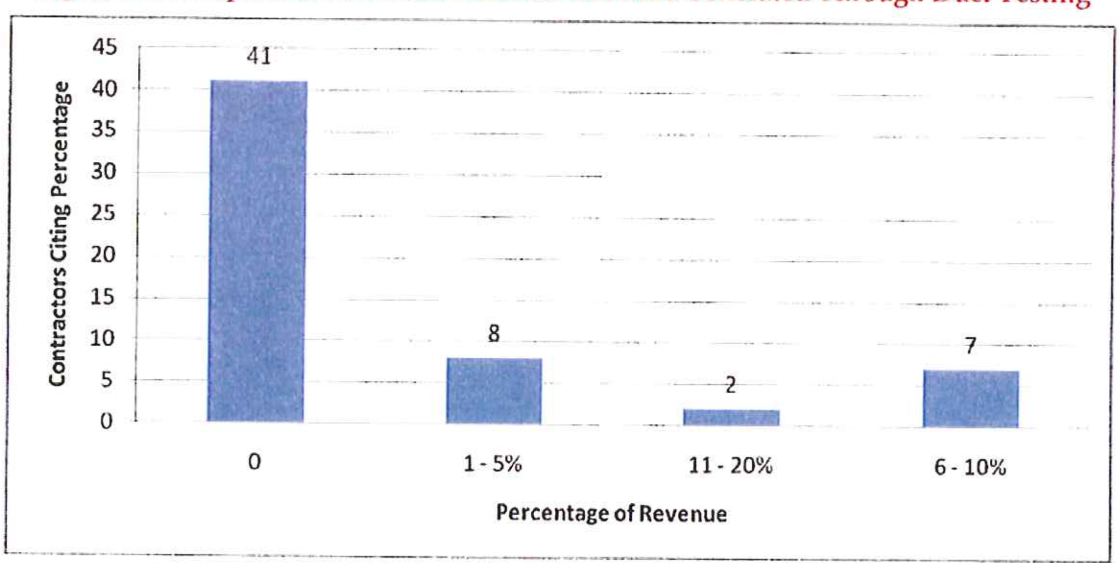


Figure 5-12: Proportion of Overall Business Revenue Generated Through Duct Sealing

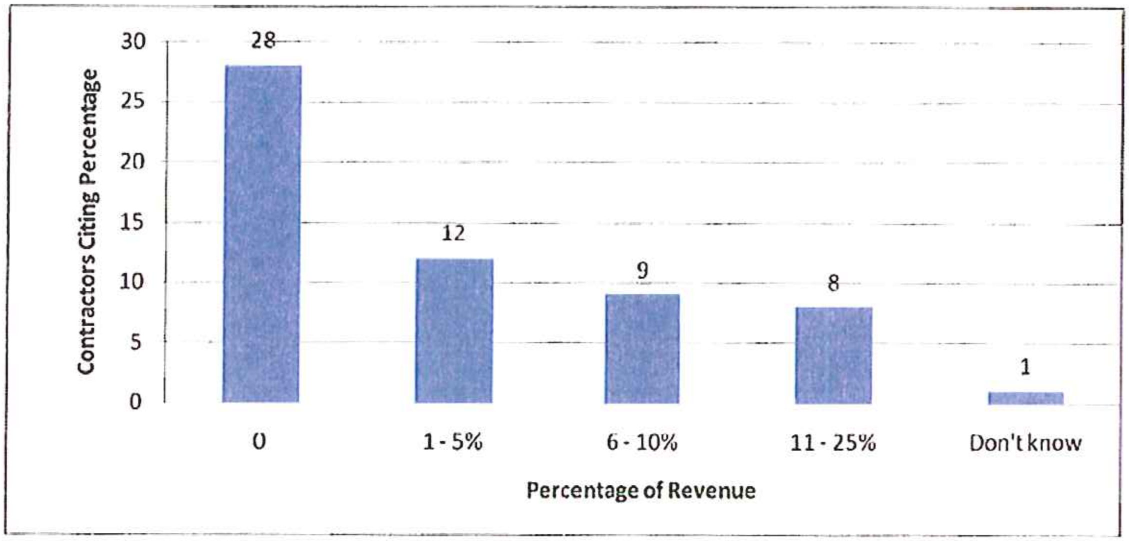


Figure 5-13: Proportion of Overall Business Revenue Generated Through HVAC Replacement

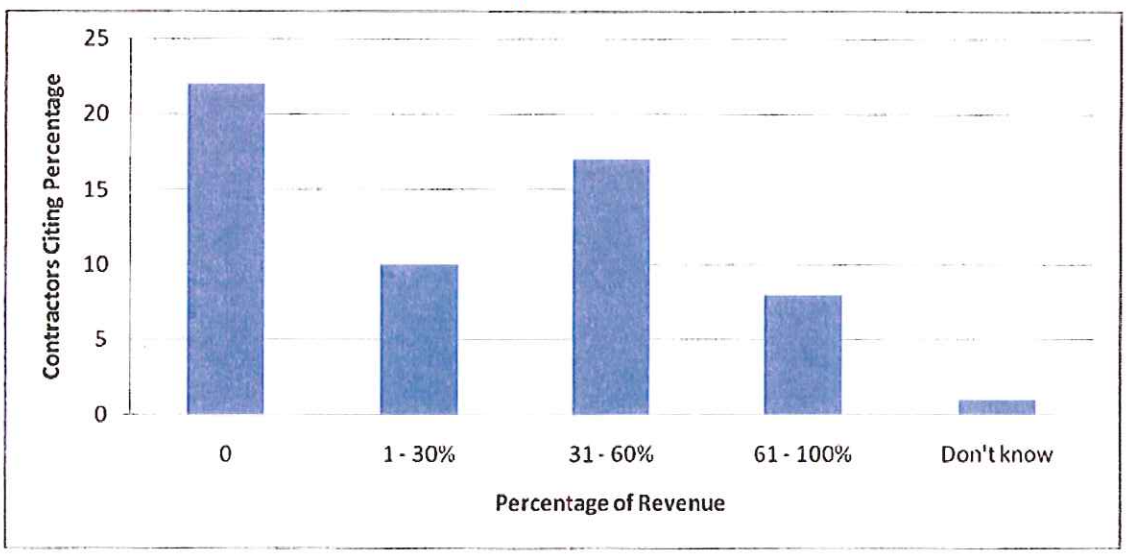


Figure 5-14: Proportion of Overall Business Revenue Generated Through Window Replacement

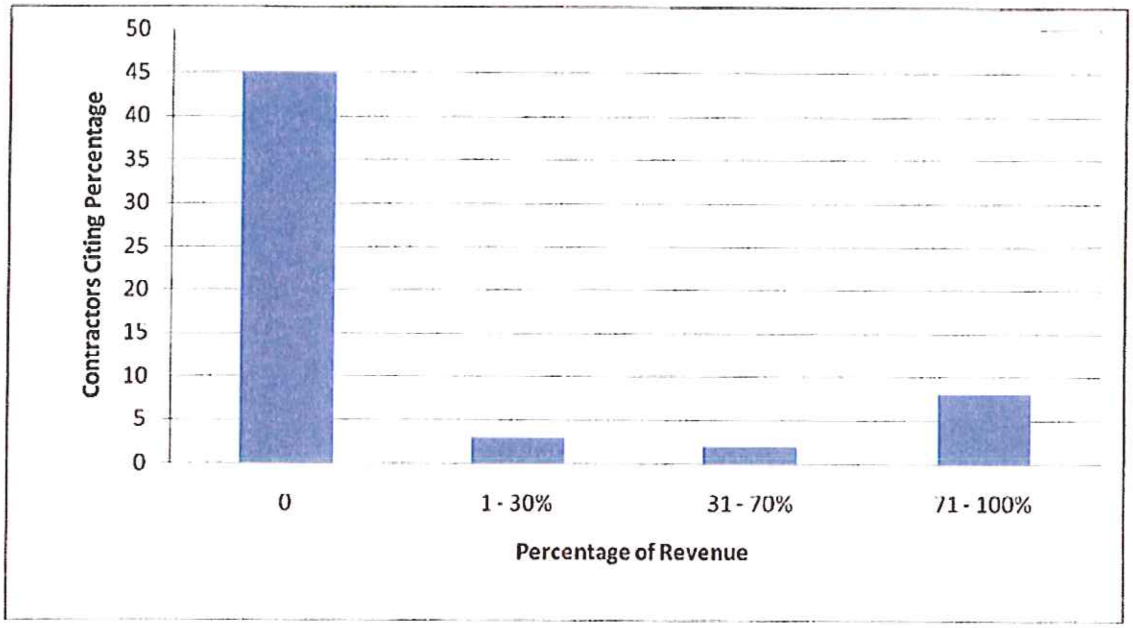
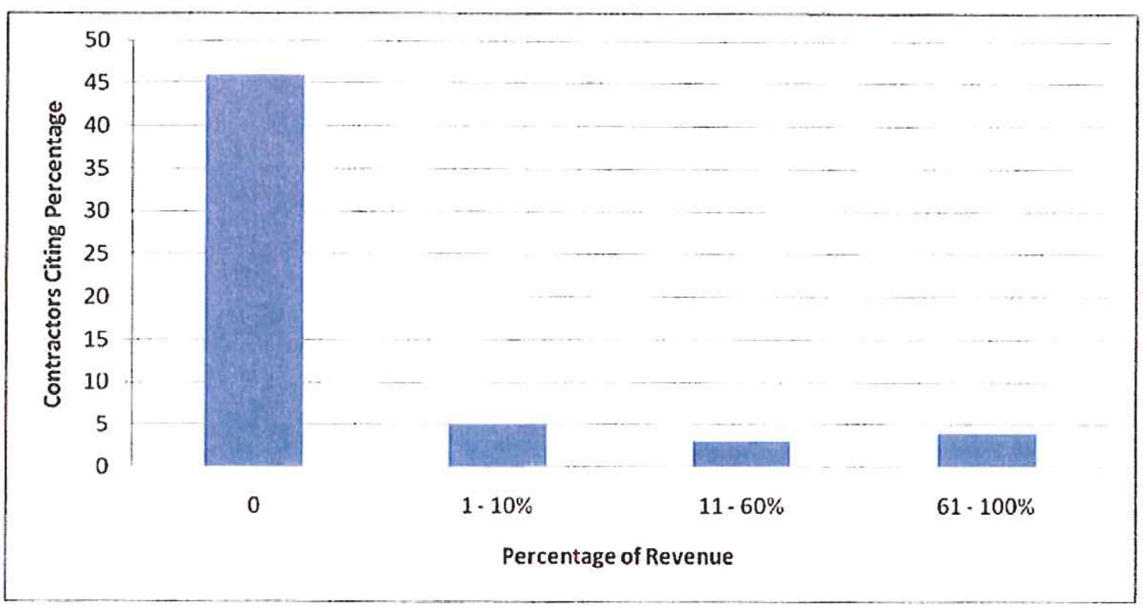


Figure 5-15: Proportion of Overall Business Revenue Generated Through Insulation Upgrade and Sealing



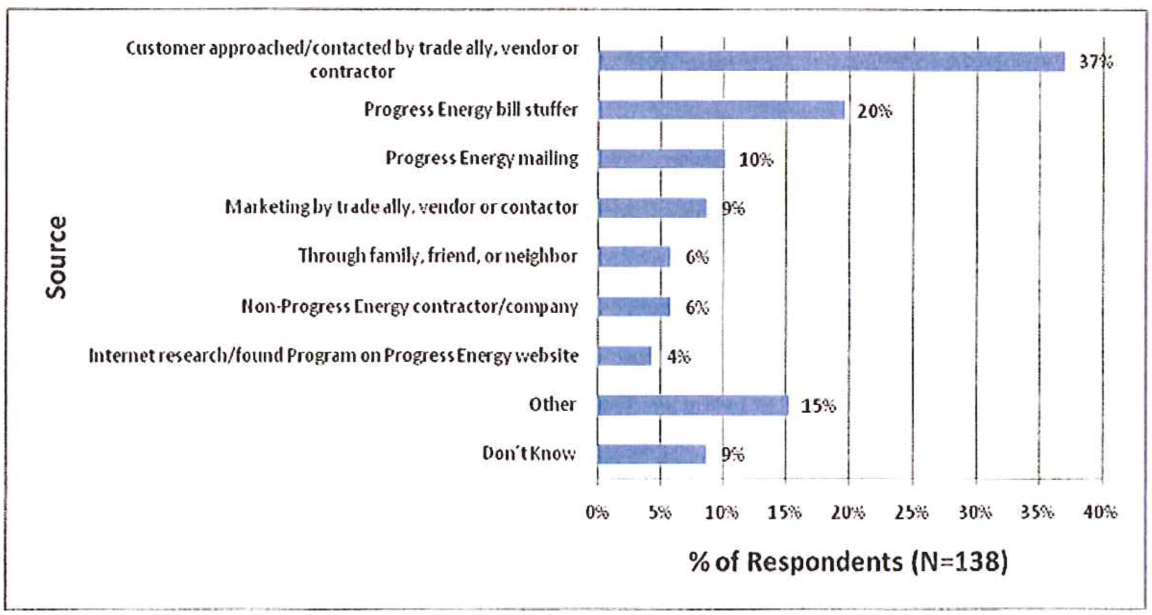
Program Participant Survey Results

NCI designed and implemented a telephone survey with 138 Progress Energy Home Energy Improvement Program participants. The surveys were designed to assess multiple program aspects, including program awareness and experience, sources of information about the program, satisfaction with key aspects of program delivery and the overall program, influence of the program on knowledge and behaviors, barriers to and benefits of participation, and suggestions for program improvements.

Program Awareness

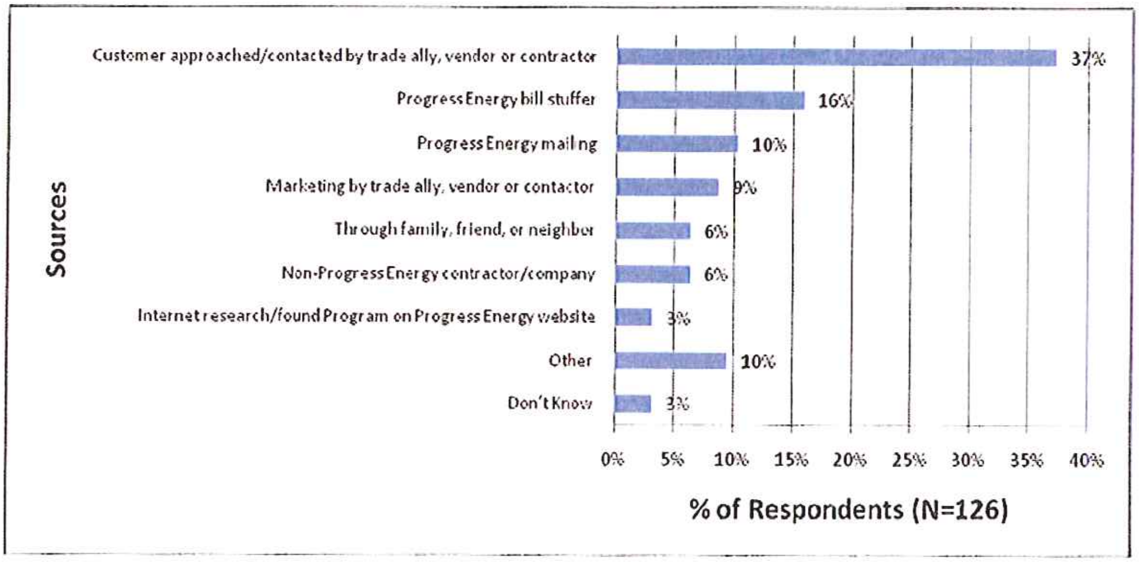
Survey results indicate that contractors play a very important role in the program process. Participants were asked to indicate all the sources through which they learned about the program; 37% learned about the program through direct contact from a contractor, while 9% learned about it through contractor marketing. Figure 5-16 shows the range of ways in which customers found out about the program.

Figure 5-16: Where Program Participants First Learned about the Program



When asked to rank the importance of the information sources from which they learned of the program, 30% of program participants cited a PEC source (bill stuffer, direct mailing, or website), while 46% cited contractors. The survey results suggest that, while PEC's marketing materials are effective, contractor communications are even more so. Figure 5-17 shows the full range of responses to this question.

Figure 5-17: Most Important Sources of Information



Customer Satisfaction

On a scale of 1 to 10 where 10 is excellent, 86% of participants ranked their overall experience with the program as an 8, 9, or 10, with 60% responding that their experience was a "10," or that they were "extremely satisfied." The only person who was dissatisfied with the program (a ranking less than 5) cited three reasons for dissatisfaction:

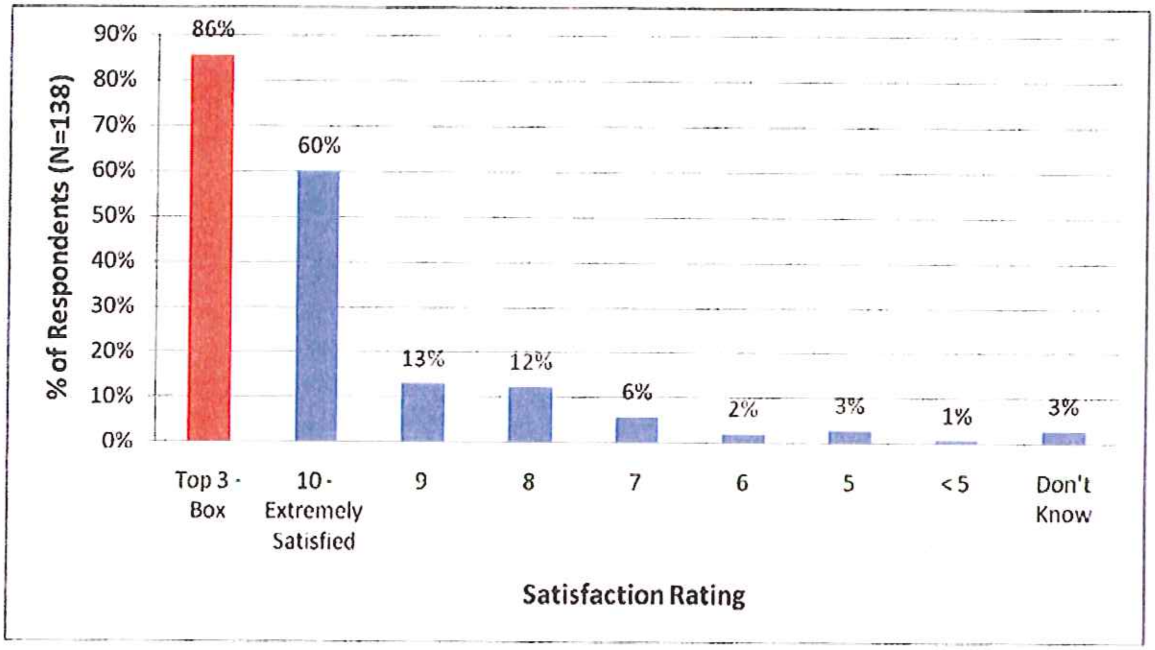
-*"Wouldn't allow us to select our own contractor/Contractors needed to be qualified."*

-*"Repairs were missed."*

-*"Repairs were not done properly."*

Figure 5-18 shows the breakout for customer satisfaction.

Figure 5-18: Overall Satisfaction with HEIP Program



Satisfaction with Key Aspects of Program Delivery and the Overall Program

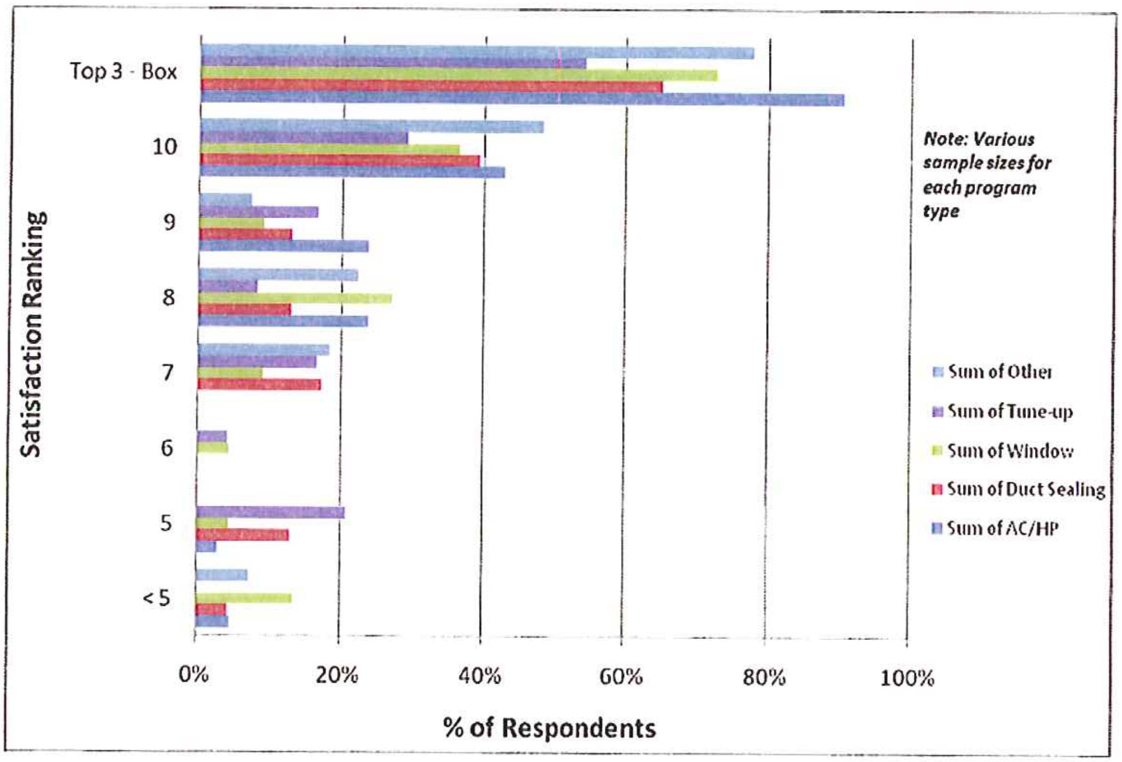
The survey asked participants about their satisfaction with several key program aspects, including satisfaction with the information provided, program costs, and with the specific program components. Customers were asked to rank their level of satisfaction with providing program information on a scale of 1 to 10, with 10 meaning "extremely satisfied." Most customers were highly satisfied, grading the program with an 8 or higher. Only five total customers graded the program below a 5; four offered the following reason:

-*"Lack of information/ didn't know much about the program."*

The remaining customer declined to comment on his or her low rating.

Figure 5-19 shows customer satisfaction with providing program information for the various program components.

Figure 5-19: Satisfaction with Program Information Provided



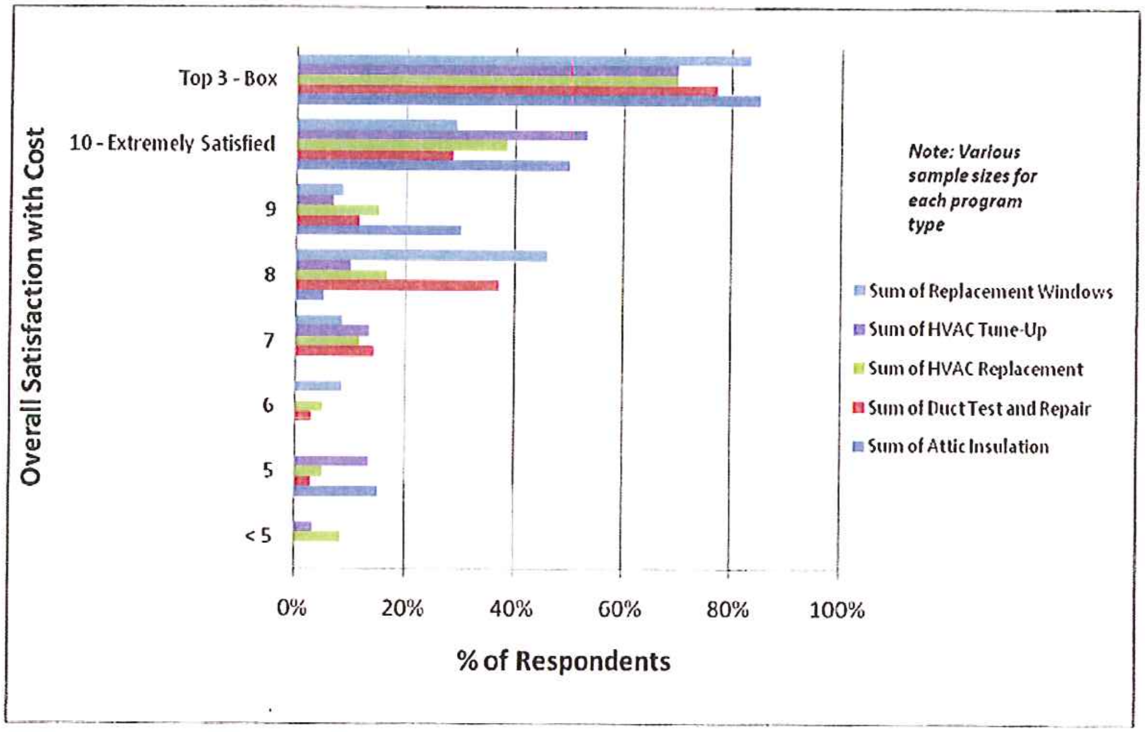
Most customers were satisfied with program costs. When aggregated by measure, at least 70% of the customers who installed each measure were satisfied or very satisfied with the measure's costs, on a scale of 1 to 10. In fact, well over 50% for each measure gave the program costs a perfect "10" ranking, meaning that they were extremely satisfied. Those who were not satisfied (<5) cited only one reason for their low rating:

-*"Can't get rebate from contractor."*

All other respondents who gave a rating below 5 declined to give specific reasons.

Figure 5-20 shows customer satisfaction with program costs.

Figure 5-20: Overall Satisfaction with Cost of the Various Installations



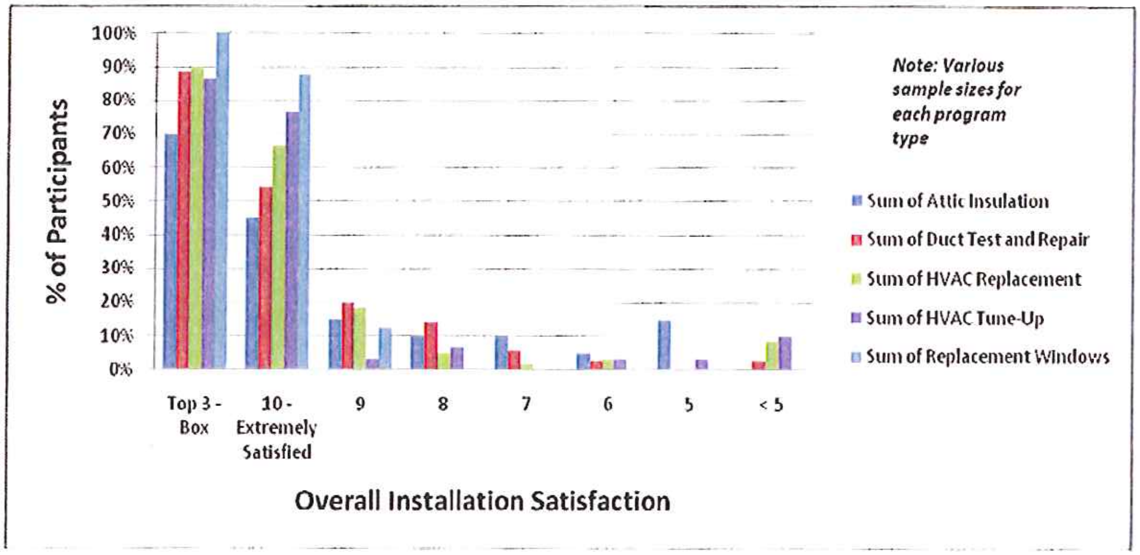
Not surprisingly, customers also are very satisfied with measure installation. Over 70% of the customers who installed each measure consider themselves to be very satisfied with the installation. Most notably, 100% of respondents reported overall satisfaction at 8 or higher with window replacement measures. And no participants indicated dissatisfaction with replacement window installations and attic insulation installations. Those measures with which customers indicated some level of dissatisfaction included HVAC tune-up and HVAC replacement. Customers offered two reasons for their dissatisfaction:

-*"Length of time (installation) took"*

-*"Issues with contractor"*

Figure 5-21 shows the range of customer responses on measure installation.

Figure 5-21: Overall Installation Satisfaction for Various Installations

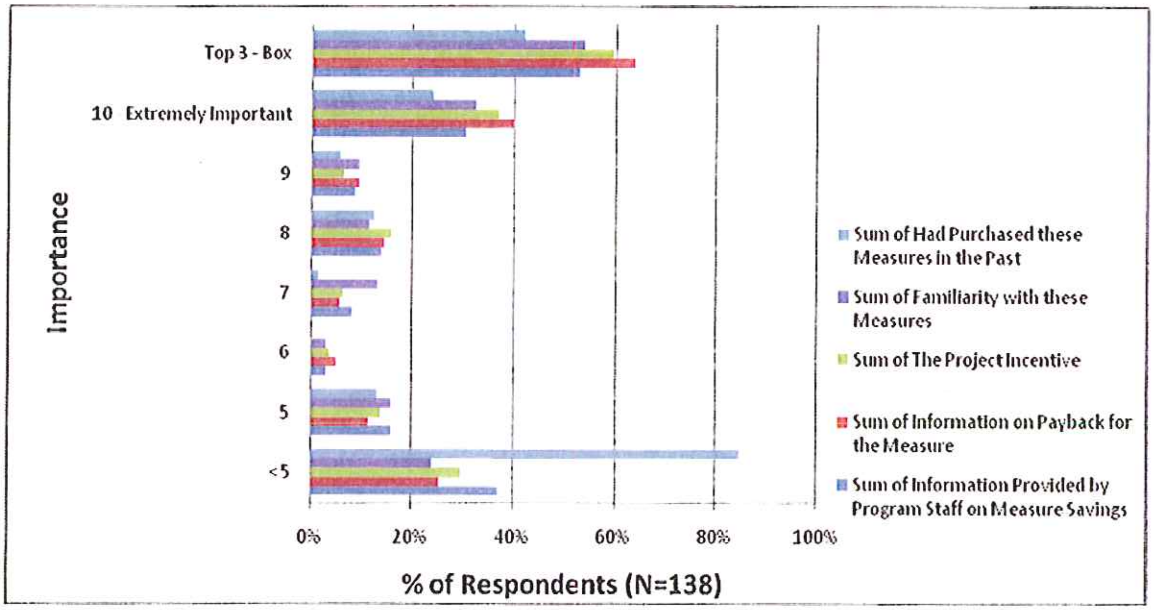


Program Influence on Customer Knowledge and Behaviors

The survey asked participants to rank the importance of various factors that led them to have work done on their homes. The most important factor, not surprisingly, was information about measure payback. Forty percent of those surveyed ranked it as the most important influence. The next most important factor was the project incentive, which 37% of participants ranked as "extremely important." The least important factor for having one of the HEIP measures completed was participants having purchased the measures in the past, which 85% of respondents ranked as "not important."

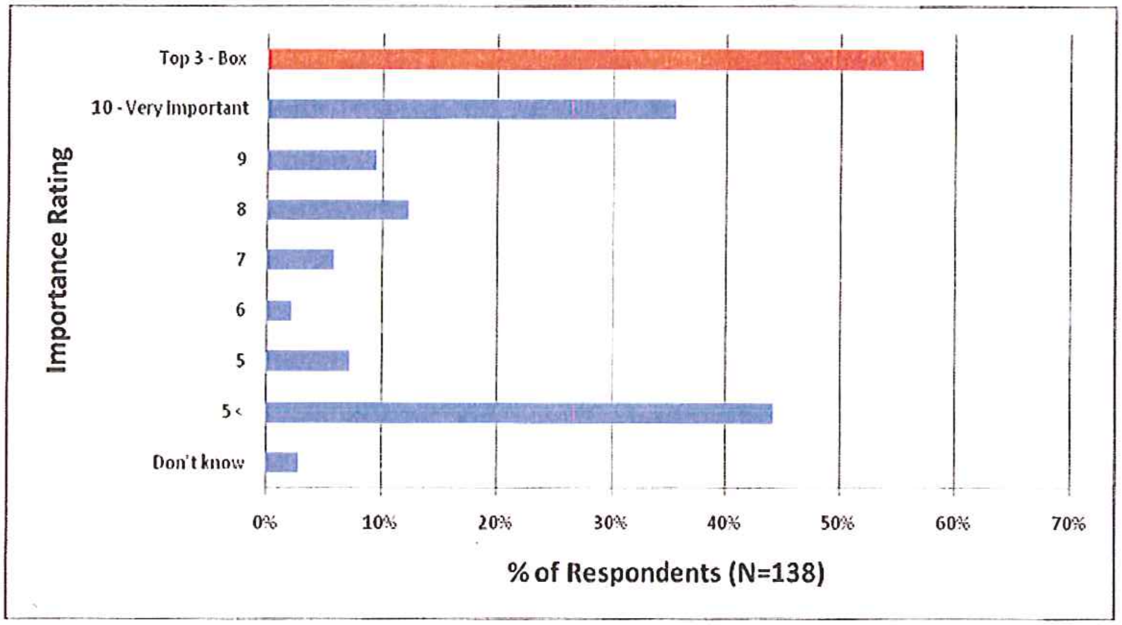
Figure 5-22 shows the various rankings.

Figure 5-22: Factor Importance: Comparison of Various Factors



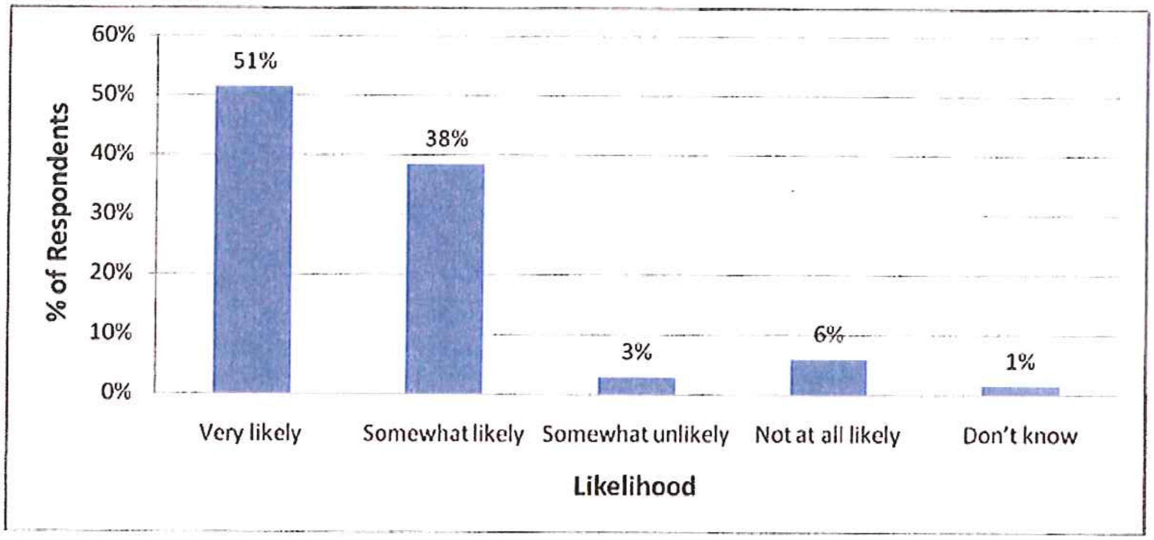
Participants were then asked how important the HEIP program was in influencing them to install additional energy efficiency measures. Participants split evenly on their responses: 57% said it was "very important" or higher, including 36% who ranked it as a 10, or "extremely important." However, 44% ranked it as less than 5, signifying a lack of influence. Figure 5-23 shows the various rankings.

Figure 5-23: Importance of HEIP in Influencing Additional Energy Efficiency Installations



Eighty-nine percent of participants said that they would have installed the measures without participating in the program, as shown in Figure 5-24.

Figure 5-24: Likeliness to Install the Same Equipment if were Unable to Participate in HEIP Program



Suggestions for Program Improvements and Benefits of Participation

The survey asked participants if they had encountered any problems, delays or difficulties with the HEIP program. Eighty-six percent responded positively saying that they encountered no issues with the program, while 13%, or 18 participants, responded negatively saying that they did in fact encounter a problem, delay or difficulty. Of the 18 participants citing an issue, 15 cited specific difficulties, with the largest issue (four respondents) relating to rebates. Three other customers cited problems with the application form, and an additional three said they had trouble with a lack of coordination and communication among Program staff. (Figure 5-25)

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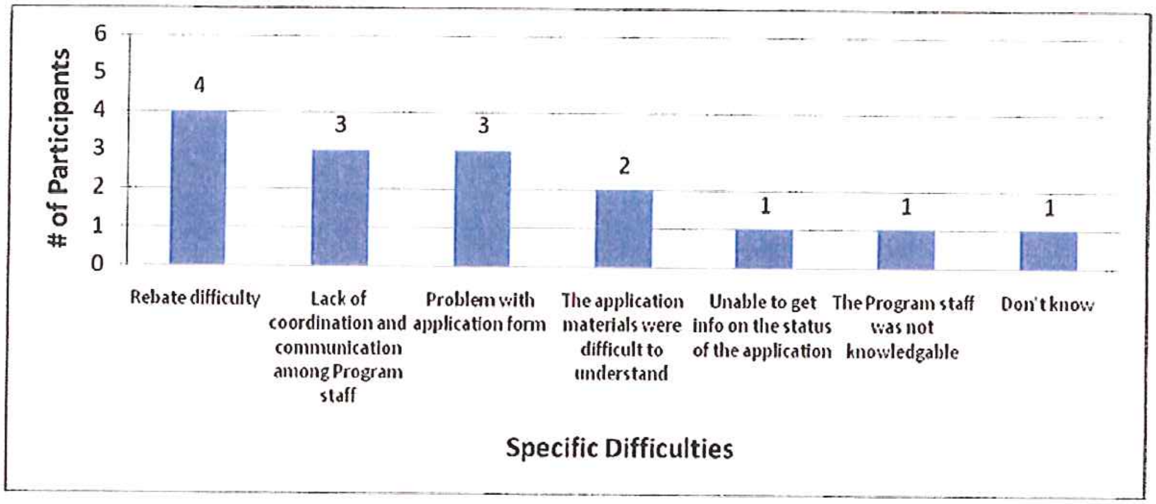
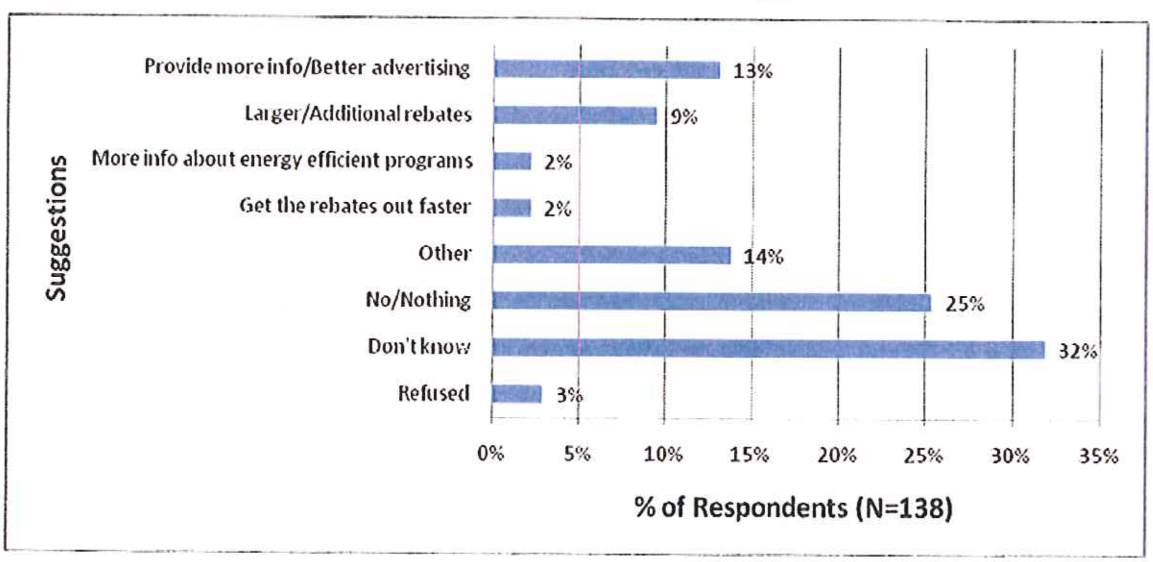
Figure 5-25: Specific Issues that Cause the Most Difficulty



When asked if they had any recommendations to improve the program, 25% of participants said that they had no suggestions, with 32% saying that they simply did not know. The most popular suggestions listed were for the Program to provide more information / better advertising (13%), larger and/or additional rebates (9%), more info about the energy efficiency programs (2%), and getting the rebates out faster (2%). Figure 5-26 shows these results.

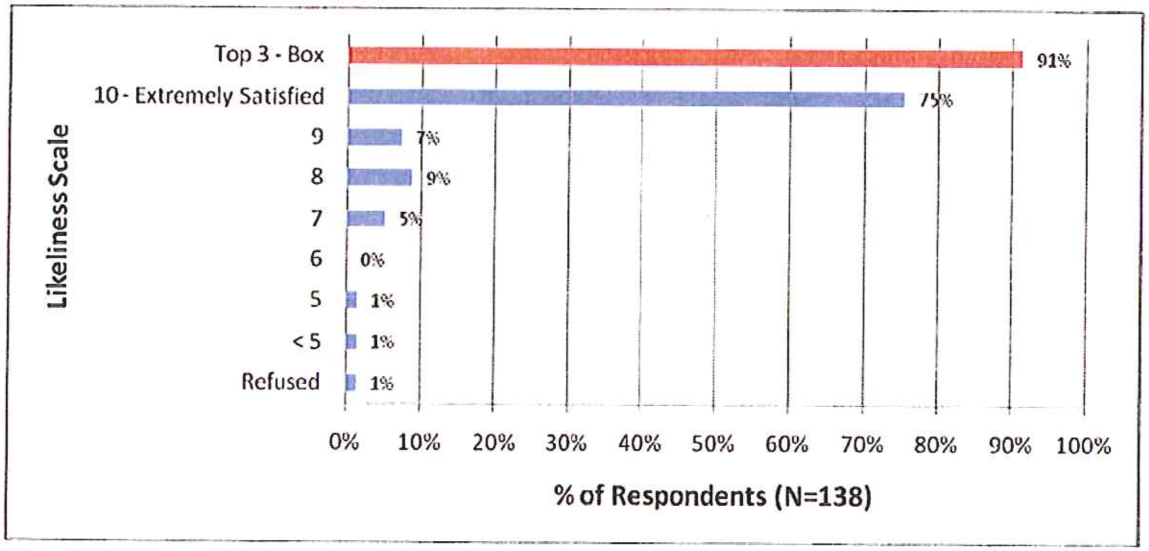
Figure 5-26: Program Changes and/or Suggestions



Ninety-one percent of the participants said they would definitely recommend the HEIP program to others. Figure 5-27 shows these results.

Only one program participant indicated that they would not recommend duct sealing specifically, and their reason was that there is *"No reason to do it / No incentive."*

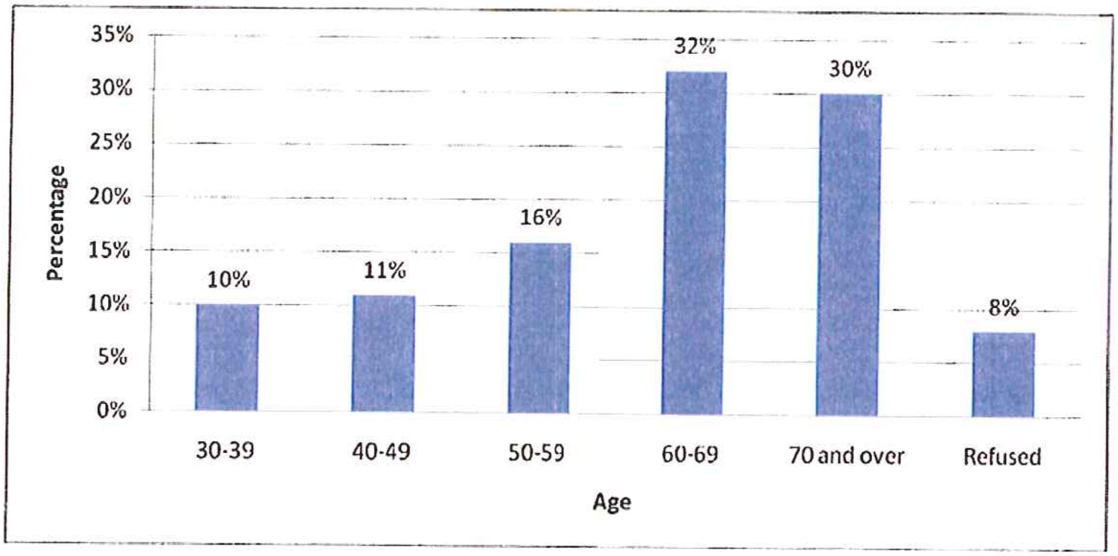
Figure 5-27: Likeliness to Recommend the HEIP Program to Others



Customer Demographics

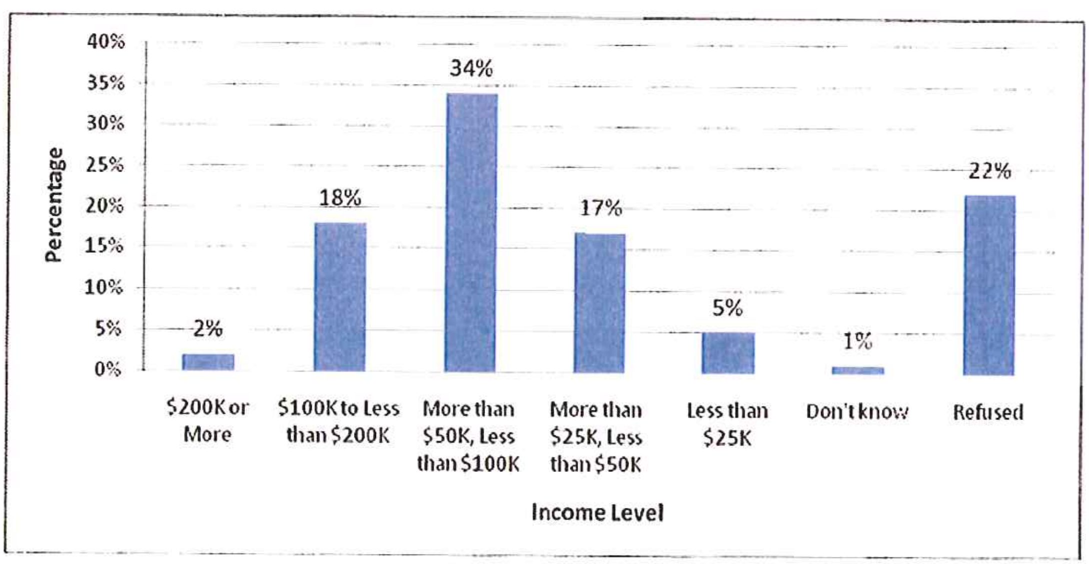
Most of the participants surveyed are near or in retirement, which may explain why they are motivated to make their energy dollars go farther. (Figure 5-28)

Figure 5-28: Age of Those Surveyed



The surveyed customers represent a range of household incomes, as shown in Figure 5-29.

Figure 5-29: Household Income



Program participants are, overall, well-educated; more than half have completed at least a bachelor's degree, and another 16% have at least some university education. (Figure 5-30)

Figure 5-30: Participant Education